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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Artificial Production of Foodstuffs

DR. C. STEINMETZ, of the General Electric Company, U.S.A., has been discussing lately the problems of harnessing solar energy and the production of foodstuffs by the aid of micro-organisms. The report of Dr. Steinmetz's statements brings to mind what has been done in this and other countries on these lines to forward researches which will ultimately be of inestimable benefit to mankind. In connection with the first problem, the work of British chemists, among whom should be mentioned Moore, Baly and Heilbron, and of Willstätter abroad, has already resulted in considerable progress in the realm of what is termed "photo-catalysis." Carbonic acid can be converted into formaldehyde in the presence of water when the gas is exposed to light of very short wave-length, but not in visible light. But if a substance be present which forms an addition complex with carbonic acid, this reaction proceeds apace, and malachite green and other basic colouring-matters have been found to act well in this respect. Thus in presence of this colouring-matter, formaldehyde is produced from carbonic acid and water in sunlight. As a result of this discovery we can now understand to some extent how the plant builds up its complex components of sugar, starch and other compounds. The reaction cited above is the first stage in the growth of living plants. Willstätter has shown that the chlorophyll of plants can form a complex with carbonic acid and water, and this reaction goes on in the leaves of plants with evolution

of oxygen. When the molecules of formaldehyde are produced they are of great reactivity, and consequently they can form, with the potassium nitrite present in the leaf, the compound form-hydroxamic acid, which then combines with more formaldehyde to result in the synthesis of aminoacids—the forerunners of proteins—and of many other important nitrogenous substances, such as alkaloids and related bodies. Further, the formaldehyde also condenses to produce the hexose sugars and other more complex carbohydrates. All these reactions have now been produced with chemical substances in the laboratory without the intervention of living plant tissues, epoch-marking work which has been accomplished by Baly and Heilbron, and their co-workers.

The problems underlying the production of foodstuffs by using certain bacteria and yeasts having unique properties made some progress in enemy countries during the war, owing to food shortage. A great field of research is opened out by these discoveries. Yeast may be employed as cattle food, and even as human food when treated suitably to rid it of bitter constituents. Yeast-extracts resembling meat-extracts, which appear not to contain vitamins as does yeast extract, have been on sale for many years. A fungus growing on trees in the East has been found to harbour certain bacteria which have the power of producing protein and fat from inorganic nitrogen compounds (ammonia) in presence of certain other inorganic salts and carbohydrates. If desired, therefore, it is now possible by making use of this new organism to obtain foodstuffs from ammonium compounds (made synthetically from the nitrogen of the air) and carbohydrates (obtained by acting with acids on wood-cellulose). In this way we can synthesise fats and proteins by the agency of a minute living organism. There can be no doubt that these suggestive results are destined to lead to still greater things in the future. An organism may some day be found, for instance, which will readily break down the cellulose of wood—which in the form of sawdust is now largely a waste product—giving us sugars which may be utilised for food purposes. As is well-known, glycerin can be produced in large quantities by the alkaline fermentation of sugar solutions by yeast, as much as 35 per cent. or more of the sugar being converted into glycerin. We are only on the threshold of the wonderful vista which this line of research offers to the experimenter. The living yeast or bacterial cell can adapt itself to very great changes in environment. In the future we shall, no doubt, see the further exploitation of the properties of these minute cells working under unusual conditions, whereby we may obtain not only food substances, but other valuable materials for use in the arts and industries, thus revolutionising trade and commerce, and heralding a new era of scientific progress.

Preservatives in Foods

SOME few weeks ago we announced that the Ministry of Health had appointed a Committee to enquire into the use of preservatives and colouring matters in foods, and to report (1) whether the use of such materials or any of them for the preservation and colouring of food is injurious to health, and, if so, in what quantities does their use become injurious; and (2) whether it should be required that the presence of such materials and the quantities present in foods offered or exposed for sale should be declared. These terms of reference do not appear to include the question as to whether such additions are necessary in foods, but probably the Committee may think it is within its power to make recommendations as to which, of any, foods require a preservative at any season of the year. Whatever opinions may be held as to the necessity of preservatives in foods, we feel that an impartial enquiry is urgently desirable, as these additions are becoming more common and in very few cases is there any disclosure of their presence. Dr. R. Dudfield, Medical Officer of Health for Paddington, has recently published the results obtained in reply to a questionnaire sent to all parts of the country, the analyses having been made by the various public analysts on foods submitted to them under the Sale of Food and Drugs Acts. It was found that the following foods, *inter alia*, contained the maximum amounts of preservative stated: Bacon, 35 grains boric acid per pound; Dried Fruit, 15.2 grains sulphur dioxide; Jam, 10.0 grains salicylic acid; Margarine, 175 grains boric acid; Fish Pastes, 105 grains; Vegetables, 10.2 grains copper sulphate per pound; and Lemon Squash, 13.1 grains of salicylic acid per pint. It cannot be doubted that in all these instances the amounts of preservative were very excessive, and it would seem that if they are to be used in certain foods there should be some restriction as to their quantity. At present these substances appear to be added, in some cases much as one would add salt, without any regard for their physiological action in the human body. The scrupulous and careful manufacturer is always placed at a disadvantage under present conditions. He tries to turn out a good article in a cleanly manner; and if any preservative be used it is in minimal amounts, because his method of preparation is carried out on hygienic lines, and he can afford to dispense with any excessive quantity of such additions. But his care and cleanliness cost money, which the less scrupulous manufacturer does not expend on his product. A preservative covers a multitude of sins against sanitary law and order.

The foods mentioned in Dr. Dudfield's list are only a few of those which are habitually found to contain chemical preservatives. Many persons to-day on a varied diet probably ingest continually doses of preservative which cannot be far removed from the maximum doses of these same substances used as medicine. The Departmental Committee set up by the Local Government Board in 1899, which reported in 1901 after hearing a very large volume of evidence from all quarters, made a number of recommendations which have never been acted upon. It was only in 1912 that their recommendations with regard to the

prohibition of preservatives in milk became law by the issue of the Milk and Cream Regulations, afterwards amended in 1917. Official inaction, therefore, has brought us to such a pass that it is imperative that the Government be pressed on this occasion, if necessary, to bring into immediate operation any recommendations which the new Committee may put forward.

The Value of Enzymes

It is often noticeable that at a conference of scientific workers, such as that represented by the chemistry section of the British Association, one particular aspect of a subject seems to be brought forward more than others. Thus, in the case in question, we find that both in the address by Professor Donnan on "Inter-faces" and in Dr. E. F. Armstrong's illuminating paper on "Enzymes" which were read on Monday, considerable stress is laid on the fundamental value of investigations as to the nature of the "large molecules" in colloidal substances. The knowledge which would seem particularly to be required concerns the outside surface of these "molecules" (if we may use this term), particularly as to shape and reacting properties, and Dr. Armstrong suggests that when this knowledge is acquired it will throw considerable light, not only on the behaviour of colloids in general but on that peculiar variety of catalytic action induced by enzymes. It is well known that enzymes are extraordinarily selective in their action, and the observation of their points of similarity to ordinary colloids indicates that it may be possible to account for this selective property by investigating them along the lines being pursued with colloids by Professor Donnan and other workers in the same field. If, and when, order is produced out of the somewhat chaotic mass of information concerning enzymes, a large and profitable field of industrial development will be opened up, since it has already been shown that valuable organic compounds may be produced quantitatively by the action of enzymes on starch, sugars and cellulose. As an example of this we may refer to the production of acetone from potatoes in Germany, before the war, by enzymic fermentation. Should these researches on colloids and enzymes render other such processes practicable, it will be one more triumph for the academic worker, whose work usually carried out simply to add to the general knowledge of a particular subject has a habit of producing something commercially remunerative in the end.

The Chemical Trade Position

THE official trade returns issued by the Board of Trade during the past few months show clearly that the hoped-for improvement which showed signs of setting in earlier in the year is now as far off as ever, and that as far as trade in chemicals goes we are now in a no better position than at this time last year. Certainly the imports received in August were of a little higher value than those in August, 1922, but it is only £1,316,000 against £1,125,000, an increase of £191,000. These figures are also an improvement on those of July. It cannot be said that this increase is due to any special item, but is rather an all-round tendency, assisted, no doubt, by the continued fall of

the German mark and other foreign currencies at a rate faster than prices can be adjusted locally, so that foreign products continue to become cheaper, although other restrictions on such trade largely prevent anything in the nature of dumping. The export side, however, is of greater interest to the manufacturer at home, and here we find that whereas in August, 1922, the value of chemicals, dyes, drugs and colours exported was £1,663,000, this August it was £17,000 less. Although neither exports nor imports of particular items are reliable indications of the state of trade, taken as a whole they are a not misleading barometer of the prosperity of the industry. It may be noted as very satisfactory, however, even in the export position, that a large group of products show favourable increases, in some cases more than double the quantities now being exported compared with last year. This group includes the whole range of coal-tar products, benzol, naphthalene, tar oil and other "crudes," and also the synthetic dyestuffs which continue, month after month, to show figures five or six times greater than those of last year. This is one of the bright features in the present position, the other being the statement in our market reports during the past few weeks that inquiries and orders are now becoming more numerous. A real revival in trade, however, awaits the settlement of the politics of Europe, and some guarantee of peace.

Broadcasting Chemical Publicity

THE authorities who control and arrange the broadcasting programmes in this country have already established a reputation of liberality in the choice of subjects, and they are, we believe, actuated not only by the obvious commercial aim of providing entertainment for as wide a circle of listeners as possible, but also with the idealistic motive of raising the general standard of taste and education. This, on the whole, is being done unobtrusively, but it is only to be expected that at times complaints should be made. This was the case, we understand, last week, on the occasion of the broadcasting of Sir Ernest Rutherford's presidential address before the British Association. To listen for an hour to a discourse on the inner nature of the atom may well have seemed dull to those who had no knowledge of the A.B.C. of the subject and who were waiting for the latest "fox-trot" to start. It is satisfactory to note that a strong defence of this particular case was made by the authorities, who are clearly alive to the importance of science to the community. The description "high-brow," however, could not be hurled at Mr. Woolcock's talk from London on Wednesday, which clearly brought home to the ordinary man the value and importance of the chemical industry as a whole to this country at the present time. Publicity of this kind is bound to be good for the industry indirectly, a fact which has been recognised in the United States, where popular talks on chemistry were broadcast from New York once a week during June. In commenting upon this fact at the time, the suggestion was made that a similar policy might be advantageous here, which suggestion we are glad to note has now been translated into fact.

The National Gas Exhibition

ON Monday last the Lord Mayor of Birmingham opened in that city an exhibition which should go a long way towards proving that the industry associated with one of our oldest commodities is still full of vigour and confidently looking forward to ever-increasing prosperity. The National Gas Exhibition should make a direct appeal to all associated with the chemical industry, for here they will find an opportunity for studying in detail the highways and byways of all manner of processes in which the primary operation of coal carbonisation forms the starting point. The gas industry is one which differs essentially from almost every other industry in that it finds a place in nearly every town in the country, and, accordingly, the scale on which the process is operated ranges in individual instances from undertakings having a capital of a few thousand pounds to those in which the capital employed runs into several million pounds. It may almost be said that there is no finality in the wonderful range of substances derived from the staple products which the gas and coke-oven industries give us, and during the last decade there has been a noticeable tendency on the part of the great undertakings (amongst which the Gas Light and Coke Company and the South Metropolitan Gas Company stand out in particular) to extend the scale of their operations and to produce and market products which seem very far removed from their primary obligation, namely, the supply of towns' gas. This extension in the range of products should, perhaps, do more than anything else to persuade those who never tire of preaching of the obsolescence of the gas industry that even though we might some day live in an electrical Elysium we shall never be able to carry on without the products of carbonisation; and, therefore, we are never likely to dispense with gas.

Points from Our News Pages

The concluding section of Mr. S. Ellingworth's article on "The Photo-Sensitising Dyestuffs" is published this week (p. 302).
A further letter is published on the subject of "Professor Green's Resignation" (p. 304).
Reports are given of the principal chemical papers read at the Liverpool meeting of the British Association (p. 308).
According to our London Market Report, the slight improvement in demand noted last week continues (p. 321).
Business in the Scottish chemical market has been slightly more satisfactory during the past week according to our report (p. 324).

The Calendar

Sept. 17 to Oct. 3	National Gas Exhibition.	Bingley Hall, Birmingham.
Oct. 3	Society of Public Analysts. 8 p.m.	Burlington House, Piccadilly, London.
4	Chemical Society: Ordinary Scientific Meeting. 8 p.m.	Burlington House, Piccadilly, London.
5	Society of Chemical Industry (Manchester Section): "Recent Progress in Chemistry," by Dr. H. Levinstein.	Manchester.
6	West Yorkshire Metallurgical Society: Annual Meeting.	Huddersfield.
13	Mining Institute of Scotland: General Meeting.	Edinburgh.

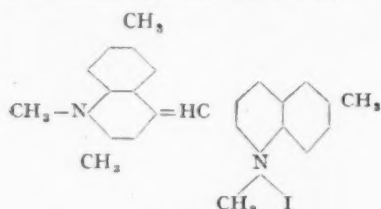
The Photo-Sensitising Dyestuffs.—(II)

By S. Ellingworth, M.Sc.

In his first article (THE CHEMICAL AGE, September 28), Mr. Ellingworth dealt with the cyanine and apocyanine dyestuffs, and pointed out that more attention has been devoted to the isocyanines than to any other groups. In his concluding article he continues his description of this and other groups.

AN interesting series of isocyanines has been prepared by Pope and Mills (*Phot. J.*, May, 1920), with the object of examining the influence on sensitising power of substituents in the two nuclei, and also of changes in the N-alkyl radicle. Briefly, they found (a) that sensitising power diminished progressively from the dimethyl to the di-n-butyl derivative. (b) The introduction of a 6 methyl group into the "quinaldine" nucleus produced a more uniform sensitisation. A similar group in the "quinoline" nucleus depressed the maximum of sensitisation.

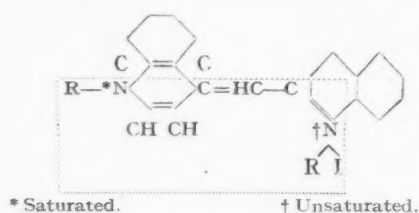
The isocyanine prepared from p-toluquinaldine methiodide, i.e., 1:1'2'6'-6' penta methyl isocyanine iodide



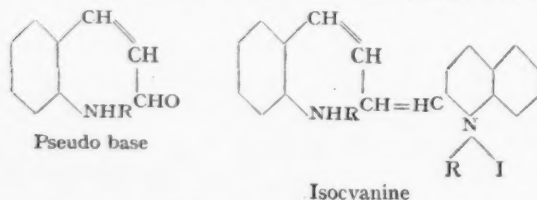
also showed a depression of the maximum.

(c) Substituent 5 or 6 amino groups augmented the sensitising power. The replacement of the amino group by an acetamino group had a depressing effect, particularly in the case of the 5-derivative. On the other hand, a cinnamoyl group was less of a depressant than the acetyl group, a fact possibly connected with the unsaturated character of the former. (d) Groups introduced into the 2-position of the "quinoline" nucleus had a very marked depressing effect. Pope and Mills suggest that the sensitising action of these substances may be related to the presence of two basic groups, one saturated (tri-valent nitrogen), and the other unsaturated (quinque-valent nitrogen), connected by a chain of conjugated double linkages, the feeble action of substances substituted in the adjacent 2-position lending some support to this view.

This particular constitutional arrangement, which apparently exists in all the powerful cyanine sensitisers, and is possibly essentially important, is clearly marked in the isocyanine formula herewith:—

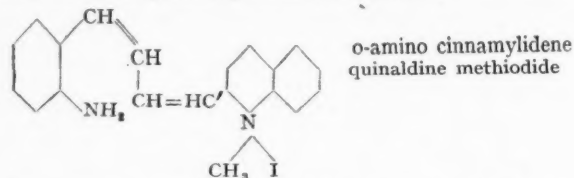


Brief mention may be made of the open chain formula proposed for the isocyanines by König (*Journ. für prakt. Ch.* (1912), (ii), 86, 166) which might follow from Roser's formula for the intermediate pseudo-base (*Annalen* (1892), 272, 221).



The work of Mills and Wishart, however, leaves little doubt of the correctness of the di-quinoyl formula, and the improbability of the open chain structure is further emphasised by the subsequent work of Mills and Evans (*Trans. Chem.*

Soc. (1920), 117, 1,035), who synthesised the almost identical o-amino cinnamylidene quinaldine methiodide,

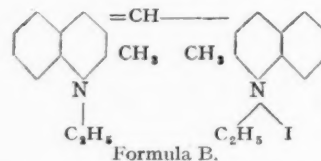
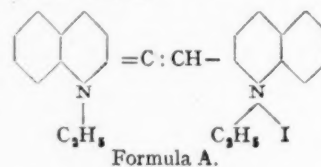


and found it to possess no sensitising properties whatever.

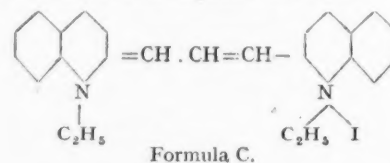
The Carbocyanines

In the year 1905 the firm of Meister, Lucius and Brünig placed on the market a new sensitiser under the name of Pinacyanol, since known as "Sensitol Red." This substance was obtained by the action of caustic soda on an alcoholic solution of the ethiodides of quinoline and quinaldine in presence of formaldehyde, giving a beautiful blue solution, which, when applied to photographic plates, conferred greater sensitiveness to red light than any of the substances hitherto employed.

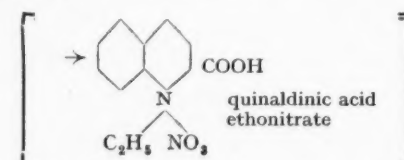
For Pinacyanol, two formulae were originally suggested, (A) by O. Fischer (*Journ. für prakt. Chem.* (1918), ii, 98, 204), and (B) by Wise, Adam, Stewart and Lund (*Journ. Ind. and Eng. Chem.*, 1919, 11, 460).



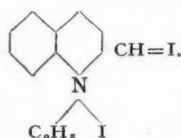
The second formula (B), it will be noted, is that of a "normal" cyanine, and is scarcely likely to be correct in view of the much more powerful sensitising action of Pinacyanol when compared with substances of this type. On the other hand, formula A has been shown by Mills and Hamer (*Trans. Chem. Soc.* (1920), 117, 1550) to be out of accord with the results of analysis, a third formula (C) being put forward by them as a result of their experimental work.



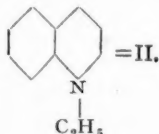
The carbocyanine was oxidised with dilute nitric acid, and yielded 83-90 per cent. of the theoretical amount of quinaldine acid ethonitrate:—



Subtraction of the added oxygen atoms from this molecule leaves the residue I



Moreover, oxidation of the carbocyanine with potassium ferricyanide gave a 60 per cent. yield of 1 ethyl 2 quinolone, which was also obtained in 70 per cent. yield when potassium permanganate was employed as oxidising agent. Oxidation with dilute nitric acid of the residue after separating the quinolone again yielded quinaldinic acid ethonitrate, although only 30 per cent. of the theoretical quantity was isolated. From the formation of the quinolone the presence of the group II



must be concluded, and in view of the intensely coloured character of the carbocyanines the connecting chain between the two quinoline nuclei most probably takes the form of two conjugated ethylenic linkages: $\text{CH} \cdot \text{CH} : \text{CH} : \text{CH}$. This consideration, in conjunction with the two residual groups I and II points to the formula C, which, moreover, agrees well with analytical and molecular weight determinations. This constitution also preserves the particular nitrogen-carbon-nitrogen system previously remarked when considering the isocyanines.

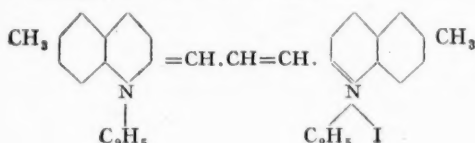
The lengthening of the connecting chain of conjugated double linkages may be in some degree responsible for the enhanced sensitising action of the carbocyanines. It will be noted that the quinoline alkyl iodide employed in the preparation of these substances does not appear as part of the product, but its presence gives rise to a higher yield of the carbocyanine. This fact, although the precise mode of action is not understood, has been emphasised by the recent work of Hamer (*Trans. Chem. Soc.* (1923), 123, 246), the constitution of pinacyanol as expressed by formula C. also receiving further confirmation.

The effect of substitution in the two nuclei has been examined by Pope and Mills (*Phot. Journ.*, Nov., 1920), on similar lines to their investigation in the isocyanine group. It is obvious, of course, that the same substituent must appear symmetrically in each nucleus, a limitation which does not exist in the case of the isocyanines. As might be expected, therefore, the effects of substitution are not altogether comparable with those of the previous series. Increase in size of the N-alkyl radicle showed an anomaly in that the diethyl derivative was a much more powerful sensitiser than the corresponding dimethyl compound, a gradual decline in sensitising power being then manifested through n-propyl to n-butyl.

Para (6) methyl groups introduced into the nuclei increased the sensitiveness in the orange region, whereas para-ethyl groups had the reverse effect. The introduction of two para-amino groups into the molecule of Pinacyanol did not extend the region of sensitiveness when compared with the parent substance, but the presence of an acetyl radicle in each of these groups had a marked depressing effect. Nuclear halogen also acted as a powerful depressant.

None of the substituted compounds appeared to sensitise quite as satisfactorily as the parent 1:1 diethyl carbocyanine iodide (Pinacyanol), which conferred extra-sensitiveness extending to $\lambda=7000$.

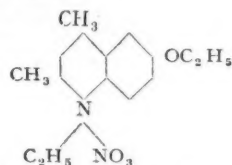
The 1:1 diethyl 6:6 dimethyl derivative.



exerted a powerful sensitising action ending very abruptly at $\lambda=7100$, but left a considerable depression in the blue-green region about 5100, the gap being more pronounced than with Pinacyanol.

The Dicyanines

The dicyanines are notable for their power of sensitisation extending into the infra-red. They are formed by the action of alkali on the quaternary alkyl halides of 2:4 dimethyl quinoline, or its homologues, or derivatives. The preparation of Dicyanine A, the best known of these substances, was described by Mikeska, Haller, and Adams (*Journ. Amer. Chem. Soc.* (1920), 42 (2), 2,392). It is obtained by the action of sodium methylate (or ethylate) in absolute methyl (or ethyl) alcoholic solution, in presence of air, on 2:4 dimethyl 6 ethoxy quinoline ethonitrate.



2:4 dimethyl 6 ethoxy quinoline ethonitrate.

A greatly improved yield of dicyanine A (twelve times that obtained by Mikeska, Haller, and Adams) was recently claimed by Palkin (*Journ. Ind. Eng. Chem.* (1923), 15, 379), sodium sulphide being used as alkali in ethyl alcohol solution (95 per cent.), chloroform also being added. The latter is stated to exert a catalytic action. The introduction of para substituent groups, as in the case of Dicyanine A, appears to increase the sensitising action, and the dicyanine obtained from 2:4:6 trimethyl quinoline is claimed to be superior to that derived from the 2:4 dimethyl compound.

The beneficial effect of the para methyl group appears to be general throughout the cyanine series.

Kryptocyanines

The foregoing paragraphs have afforded several instances of the reactivity of the 4 methyl group of lepidine, and therefore it might be expected that two molecules of this substance would unite with formaldehyde to form another type of cyanine dyestuff, just as the carbocyanines are formed from quinaldine.

The "Kryptocyanines," described by Adams and Haller (*Journ. Amer. Chem. Soc.* (1920), 42, 2, 2,661), may possibly be substances of this nature. It has already been mentioned that isocyanines can be prepared by the action of alkali in hot concentrated alcoholic solution on the quaternary alkyl halides of pure lepidine. The above-mentioned workers, however, found that if the reaction was carried out in very dilute alcoholic solution with the addition of formaldehyde or chloroform, air being excluded, a new type of dyestuff was formed, to which the name "Kryptocyanine" was assigned.

Kryptocyanines were prepared from lepidine methiodide and ethiodide, and from the ethiodide and methonitrate of p-tolulepidine. Lepidine ethiodide is said to produce the best yield of Kryptocyanine, and also to yield the most powerful sensitiser. This substance is claimed to show a sensitising maximum at $\lambda=7400$, the action extending ultimately to $\lambda=7600$, compared with a maximum at 7000 shown by the dicyanine from 2:4 dimethyl quinoline.

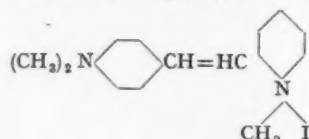
Adams and Haller also claim the formation of still another type of dyestuff by carrying out the preceding reaction without the addition of formaldehyde or chloroform. These products are provisionally termed "Hypocyanines," and their sensitising power is said to be similar to that of the Kryptocyanines.

No suggestion is put forward as to their constitution but it is possible that they may be similar to the erythroapocyanines derived from quinoline, in which, if the formula of Kaufmann and Strübin be accepted, the two nuclei are each connected through the 2 position.

Dimethylamino Styryl Pyridines and Quinolines

A new photographic sensitiser was described by Mills and Pope (*Trans. Chem. Soc.* (1922), 121, 946) which was obtained by the condensation of p-dimethylamino benzaldehyde with

α picoline methiodide in alcoholic solution in presence of piperidine. Its constitution may therefore be expressed thus :

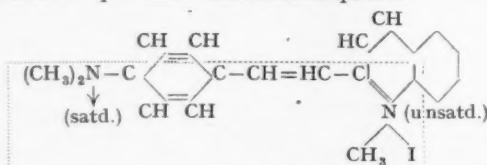


Similar compounds derived from quinaldine and lepidine had been previously prepared by König (*Journ. für Prakt. Chem.* (1912) ii, 86, 172), Barbier (*Bull. Soc. Chem.* (1920), 27, 427) and König and Treichel (*Journ. für Prakt. Chem.* (1921) [ii] 102, 63), though no mention was made of their sensitising properties.

The dimethylamino styryl pyridine methiodide obtained by Pope and Mills formed a deep orange solution in methyl alcohol and crystallised therefrom in bright red prisms showing a blue reflex. It proved to be the most powerful sensitiser for green light yet prepared for gelatino-silver bromide plates.

The plates, after bathing in aqueous solutions containing one part of dyestuff in thirty to forty thousand parts of solution and drying, displayed almost uniform sensitiveness to light of all wave lengths up to about $\lambda=5600$. The sensitive region extended as far as $\lambda=6200$. This result is valuable in view of the gap left in the blue-green region by many sensitisers.

It will be noticed that the same system of saturated and unsaturated basic nitrogen atoms, connected by conjugated double linkages, exists in these amino styryl compounds, their constitution bearing some resemblance to that of an isocyanine in which the "quinoline" nucleus is simplified.

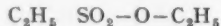


2 p-dimethyl amino styryl quinoline methiodide
(compare with isocyanine formula).

This is interesting in view of the observation previously recorded as to the depressant effect of loading the "quinoline" nucleus of the isocyanines with methyl groups.

In concluding this necessarily abbreviated account of the photo-sensitising dyestuffs, it may be remarked that a large field of investigation still remains open, from both a chemical and a photographic point of view, in order that the full benefit of sensitisation may be utilised. At present, most of these compounds are extremely expensive to produce, especially where, as in the case of Dicyanine A, complicated methyl quinoline derivatives form essential stages of the process of manufacture. Most of these materials depend for their production upon syntheses which, despite extensive research by numerous workers, give notoriously poor yields.

Mention may be made in this connection of the various patents taken out with the object of avoiding the use of the costly methyl iodide. Thus, dialkyl sulphates, methyl and ethyl p-toluene sulphonates, ethyl nitrate, acetate, and phosphate have been proposed and utilised, as have also ethyl sulpho ethyl ester



and ethyl benzene sulphonate. The production of the necessary intermediates, however, is a large and complicated problem which still remains, and the much simpler styryl pyridine sensitiser described by Pope and Mills (*loc. cit.*) would appear to be a distinct advance from this point of view.

The Antiseptic Action of the Styryl Quinolines and Styryl Pyridines

Following upon the observation of the antiseptic activity of the cyanine dyestuffs, it has recently been recorded (Browning, Cohen, Ellingworth, and Gulbrausen, *British Medical Journal*, August 25, 1923), that the dimethylamino styryl quinolines and dimethylamino styryl pyridines also possess similar properties in a marked degree.

A number of these substances were examined in their behaviour towards cultures of *Staphylococcus Aureus* and *B. Coli*. In the case of the former, the sterilising concentrations of most of the compounds lay between 1 in 200,000 and 1 in 1,000,000 in both peptone water and ox serum media. For *B. Coli*, the most powerful effect was exhibited by 2p dimethylamino styryl 6 methyl quinoline methiodide and methochloride (sterilising concentration in both media 1 in 100,000 to 1 in 200,000).

The substitution of a simple pyridine nucleus for a quinoline nucleus caused a slight reduction of antiseptic power.

National Gas Exhibition

Chemical and Allied Exhibits at Birmingham

THE National Gas Exhibition, the object of which is to demonstrate the service of gas in home and industry, was formally opened at Bingley Hall, Birmingham, on Monday. The exhibition, which will remain open until October 3, is under the control of an Executive Committee representing the Midland Commercial Gas Association, with the support of all the associations connected with the gas industry, and many of the gas companies and corporation gas departments in the country. This is the first exhibition of the kind to be held outside London.

An ornamental garden at the main entrance of this large exhibition, which completely fills Bingley Hall, has been arranged by the British Sulphate of Ammonia Federation to demonstrate the wonderful effect on vegetable life of sulphate of ammonia. Jointing material "Permac" is a feature of the exhibit by Thomas and Bishop, Ltd., London; it is claimed that acids or chemicals do not cause any disintegration. For dealing with naphthalene troubles the Shell-Mex, Ltd., London, give prominence to Mexsol—a straight run petroleum distillate, with a low final boiling point; and Shell gas oil as a washing, absorbing or extracting agent. A high efficiency gas furnace is displayed on the stall of the Industrial Research Laboratories of the Birmingham Gas Department, this has been evolved with the object of producing a heating plant of a high thermal efficiency, especially in the larger sizes having hearth areas of from 3 ft. by 2 ft., up to 12 ft. by 5 ft. The construction, which is suggestive of existing large type producer gas-fired furnaces, include a special type of counter-current regenerator applying to both gas and air supplies. Industrial chemicals and polishing equipment are exhibited by Messrs. W. Canning and Co., Ltd., of Birmingham, and Mr. Silas Hyde, Birmingham, shows gas heated solution vats for cosletting, etc., and enamelling stoves, etc.

The economy achieved by carbonising coal in gas works is demonstrated at the large stand of the British Commercial Gas Association, and the valuable by-products, thus preserved, are shown; these include sulphate of ammonia, benzol, coke, tar, dyes, disinfectants and perfumes. Refractory materials are exhibited by the Meltham Silica Fire Brick Co., Huddersfield; Gibbons (Dudley), Ltd., Worcester; the Consett Iron Co., Durham, and Mobberley and Perry Ltd., Stourbridge. A variety of instruments used in the scientific control of gas manufacture, distribution and use, are arranged by Alexander Wright and Co., of London; they include photometrical apparatus, calorimeters, laboratory meters, and equipment for determining and recording the specific gravity of gases. The Sigma Instrument Co., Letchworth, feature indicating and recording instruments for use with purified or unpurified gas.

The South Staffordshire Mond Gas (Power and Heating) Co., have a stand on which a number of chemical products are on view. These include disinfectants in liquid and solid form, based on carbolic and cresilic acid and their homologues. The latter are stated to be not only non-corrosive and non-poisonous, but of far greater germinal power than the carbolic acid compounds. In addition "Zulite" wood preservative is shown, a product which is available in 19 different shades, and used for preserving wood from rot and the ravages of insects, the panels of the stand itself being treated with this compound. Samples of neutral and ordinary sulphate of ammonia, tar oils, and pitch are also shown, while further special products exhibited include varieties of "melanoid" bituminous paints and varnishes which are highly resistant to acids, weather, and corrosion generally. Special interest attaches to the

firm's "Acarite" sheep dip which has proved so successful in some official trials arranged by the Argentine Government that it is now admitted into that country free of duty.

The Chemical Engineering and Wilton's Patent Furnace Co. are showing several items of interest to sulphate of ammonia producers, including a drier for producing dry crystalline neutral sulphate, a new saturator for use in the same process, and the Wilton patent liquor still. The exhibit also includes the well-known patent draught furnace which is specially suitable for burning coke breeze, and an example of the patent lime pump for pumping lime into sulphate plant, which is simple and ingenious in action. Several samples of crystalline sulphate are exhibited and there is also a model of a complete tar dehydration plant.

Applied Chemistry in Modern Life

We give below the greater part of the talk on the above subject by Mr. W. J. U. Woolcock, which was broadcast from London on Wednesday.

AFTER a few introductory remarks, Mr. Woolcock said: "Look around the room for a moment, and realise how very few are the articles which are colourless. Practically everything is coloured: most of the colours are produced artificially from coal tar. As usual, the discovery of the first artificial colouring matter was made in England; its development was, as you may perhaps expect, left to the Germans. In 1913, 80 per cent. of the dyestuffs used in this country were obtained from Germany and Switzerland; to-day we produce 80 per cent. of what we require and import only 20 per cent. So that if the trouble abroad should get even worse than it is at present and our great textile industry were faced with the complete failure on the Continent of the foreign dyestuffs industry, there would be no lack of dyestuffs in this country.

"The fine chemical industry is equally important in everyday life. In the home the nauseous old medicines which were in constant use in our younger days have given place to the products of the chemical laboratory. Dangerous bleeding is no longer treated with cobwebs but with pure chemicals obtained from plants and animals. The discoveries of chemists in the class of chemicals which are called antiseptics have been instrumental in saving thousands of valuable lives, and such discoveries are only the beginnings and are a mere indication of the possibilities of the chemical industry of the future.

"Again, think of the number of cameras you have seen in use during the holidays and the amount of fine chemicals which have been used to develop the photographs taken. Yet when war broke out, although we were manufacturing in England the silver nitrate and the finest photographic plates and papers, not an ounce of the fine chemicals necessary to develop these plates and papers was being produced in the British Empire.

"Some of you are seated in rooms with gas for lighting purposes. Look at the gas mantle. It is one of the best examples of the present-day use of what chemists call the 'rare earths.' Until recent years these chemicals were scientific curiosities. Chemical research has now endowed them with applications of such a practical nature that no country can keep abreast of the march of progress without making use of them. Two of them—thoria and ceria—are in the gas mantle. Some of you have 'stainless' steel knives and perhaps 'stainless' steel golf clubs—the steel has mixed with it some of the rare metals. You may have to work with high-speed tools, if so, the reason your tools withstand the high temperatures without softening is the admixture of some of these rare metals with the steel. Chemistry is the open sesame in modern industry. The constant scientific control of the manufacture of foodstuffs, of the means of locomotion, of the supply of gas and of water, is essential in modern life. But there is something infinitely greater going on in Great Britain and by reason of its very greatness it is proceeding slowly and silently. The difficulties facing vast populations if they are to live in normal times and if they are to preserve their lives in times of war have, almost insensibly, been realised by the people of Britain. It was realised in Germany some years ago. While in Britain if we had a favourite boy and were able to do so we put him in the Navy, in Germany they made a chemist of him. What our Navy

was in the estimation of British people, the German chemical industry was to the German people.

"The establishment of a complete British chemical industry is a great achievement, but its greatness does not lie in the vast sums of money invested in it or the multitude of the products it produces for us. Its supreme importance lies in the fact that it provides for the scientific brains of the country the application of discoveries to the difficulties of modern life. Without such scope of application the incentive to discovery would be lost and Great Britain must drop behind in the struggle for existence."

The Chemist's Point of View

To the Editor of THE CHEMICAL AGE.

SIR,—In your leader of September 8, you say "That the directors employ chemists and then ignore the results of their work, seems at least unlikely." Do you imply these words only to the case under discussion, or have they a general meaning?

If the latter, then let me remind you that the chemist—of course, I mean the head or responsible man in a works—does not generally come in touch with the directorate. Between the chemist and the directorate is usually a manager. Managers are chosen for reasons other than fitness for the position. Often such a man may undo the results of years of work, and then after fooling about and wasting much money, quietly allow things to be put back to the old conditions. In a private concern this could not so easily happen, as the employer is the directorate, and if losses are incurred there is, for him, no limited liability.

Such things as the following do happen:—A process had been very satisfactory for twenty years, a new manager came on the scene and, I suppose, felt he must do something. He altered the process, although the chemist warned him what the result would be. Instead of just going back to the original method when he found he had bungled, he goes on floundering until six or seven thousand pounds had been wasted, after which he allowed the process to be carried on as formerly.

A new process was adopted in many works some twenty-five years ago, and most of them applied a principle that scientists had pointed out fifty years before that. Although for twelve years the arrangement gave good results, the manager thought it (the principle) could be dispensed with and again, contrary to all the chemist could say, the manager would have his way. Quantity had to be sacrificed to get quality, until after another dozen years it was considered best to reintroduce the old principle as at first applied.

Cases like these could be quoted in plenty, besides which any suggestion of improving either production or standard of work is flouted as this: A kind of fabric that had cost a big sum to produce was far from satisfactory. The chemical staff worked out methods of improvement. Small trials were very promising. A bulk trial was made which so far as the process had gone was also promising. The manager, at a certain point, interposed in a way that spoilt the lot.

Things like these could not happen if the chemists were represented on the directorate. If money, instead of being wasted as above, was used for paying chemists' salaries and laboratory equipment, it would pay a good interest.—

Yours, etc.,

"OBSERVER."

An Increase in Unemployment

AMONG workpeople insured under the Unemployment Insurance Acts in Great Britain and Northern Ireland the percentage unemployed was 11.5 at August 27, compared with 11.3 at July 23 and with 11.0 at June 25. At the end of August, 1922, the corresponding percentage was 12.3.

The total number of workpeople registered at the Employment Exchanges as unemployed on August 27 in Great Britain and Northern Ireland was approximately 1,266,000, of whom 943,000 were men and 237,000 were women, the remainder being boys and girls. At July 30 the total was 1,235,000, of whom 936,000 were men and 223,000 were women.

The industries showing most decline included the pig iron, tinplate, shipbuilding, wool textile, hosiery textile, bleaching, dyeing, etc., furniture, and pottery trades, and some sections of the clothing trades.

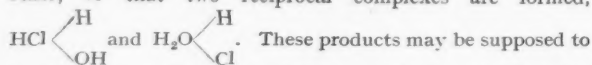
The Hydronodynast—(II)

By Henry E. Armstrong

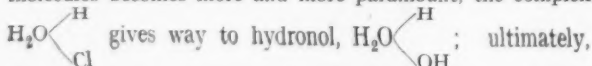
O thou sculptor, painter, poet!
Take this lesson to thy heart:
That is best which lieth nearest;
Shape from that thy works of art.

THE task before us is to fashion water and solutions, especially the latter.

7. If and when hydrogen chloride and hydrone interact, the two molecules are 'distributed,' each upon the other, so that two reciprocal complexes are formed,



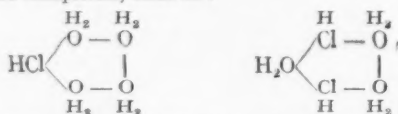
These products may be supposed to be in maximum proportion at the concentration at which the solution has maximum electrical conductivity, approximately $\text{HCl} : 9\text{OH}_2$, that at which a solution of hydrogen chloride has its greatest chemical activity: perhaps, the two are then present in equivalent amounts. I further assume that, as the solution is diluted and the influence of the hydrone molecules becomes more and more paramount, the complex



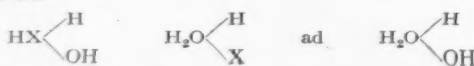
this latter may be present together with only the analogous muriated hydrol, $\text{HCl} \begin{array}{c} \text{H} \\ \diagup \\ \text{OH} \end{array}$, in equivalent proportions,

though but few salts become so entirely active. At this stage, the molecular effect (osmotic influence, electrical conductivity, etc.) of the solute is at its possible maximum and the apparent effect of the solute is bimolecular, each of the complexes being equally active, osmotically and otherwise.

8. Just as water is to be regarded as consisting chiefly of polyhydrones, so a solution may be supposed to contain a variety of similar (derived) closed systems. Thus, the more concentrated solutions of hydrogen chloride are to be thought of as containing mixed systems (derived from the primary distributed complexes) such as:



In cases, however, in which the molecular influence of the solute becomes apparently doubled and absolute—in certain very dilute solutions—it must be held that these inert closed systems give way entirely to the active, complementary, simple complexes—



9. The 'distribution' of a substance in water, in the manner set forth, must involve a reduction in the proportion of hydrone molecules. That fresh molecules are supplied to take their place by dissociation of the polyhydrones cannot be supposed—as vapour pressure falls as the solution becomes more concentrated. Apparently, the polyhydrones are hydrolysed and reduced to hydrone only in response to the demand made when the proportion of salt is increased. It follows that the composition of the "water" in a solution must vary, not only as the temperature changes but also with the concentration—the relative proportions in which the various constituents are present must be changed. This conception, that 'water' is a dependent variable in its composition and character, I believe to be a new one and one that we must specially ponder.

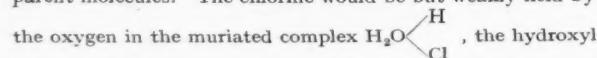
10. The conception developed in the previous paragraphs may be extended to other solvents in which no distributive action is possible, which develop no special activity in the dissolved substance, such as is produced on dissolving salts (potential electrolytes) in water. All solvents probably are to be regarded as mixtures of simple molecules with complexes formed by the association of several of these units.

11. To explain the osmotic properties of solutions, it is necessary to account for the increased affinity of solution for solvent *pari passu* with the fall in vapour pressure as the con-

centration is increased—and the astounding parallelism of the phenomena with those afforded by gases.

Non-electrolytes all produce the same effect per molecule, whatever their molecular magnitude, in raising the osmotic attractive power of water and, at the same time, of lowering its vapour pressure. The negative pressure developed within the liquid is such that, apparently, a gramme-molecular-proportion of hydrone is taken out of action as volatile constituent per gramme-molecular-proportion of the non-electrolyte dissolved: each molecule of the solute appears to 'anchor' a molecule of hydrone, yet in some special way which enables this still to preserve its attractive power for molecules of its own kind. The effect of potential electrolytes is greater, to an extent depending upon the valency and character of the constituent radicles; 'salts' of the type X^nR^1 , in very dilute solution, may produce an effect double that proper to a single molecule and the effect of salts containing radicles of higher valency than unity may be still greater.

12. Reverting to paragraph 7, the reciprocal complexes formed by the distribution of the interacting molecules *inter se* would obviously be less stable compounds than either of the parent molecules. The chlorine would be but weakly held by



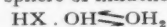
but weakly by the chlorine in the hydrol $\text{HCl} \begin{array}{c} \text{H} \\ \diagup \\ \text{OH} \end{array}$. On

the other hand, the residual affinity of the chlorine atom would be greater than that of chlorine in hydrogen chloride; that of oxygen in the hydrol and also in hydronol greater than that of oxygen in hydrone. Each such distributed system, therefore, may be thought of as eminently attractive to hydrone.

13. Each such system would have unit osmotic effect. In like manner, each molecule of non-electrolyte, dissolved in water, would have unit effect, if converted, in the process, into a hydrol, by the 'distribution' upon it of a single molecule of hydrone.

Whatever explanation we may be led to give of the peculiarities of potential electrolytes, nothing in connexion with the behaviour of non-electrolytes is more striking than the fact that they exercise unit osmotic effect per molecule. Thus, the effect of a molecule of alcohol, $\text{C}_2\text{H}_5\text{OH}$, is the same as that of one of the complex molecules of cane sugar, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$. The influence of the molecule is, in a sense, polar: apparently it is exercised from a single centre. Some inductive influence is at work, in the complex hydroxy-compound, preventing effective hydration at contiguous hydroxy-groups and favouring it at some dominant centre—perhaps at the etheric linkage between the two C_6 complexes.

14. On the view put forward, the osmotic influence exercised by the solute, made active in the manner described, is twofold. Each active unit, the formation of which has involved the withdrawal of a molecule of hydrone from the 'water,' given the opportunity, will attract a molecule of hydrone from without. This will act as a watchdog: it will hold the solute molecule in check and neutralise it, oscillating backwards and forwards within the sphere of influence of the negative radicle



15. On this assumption, 'osmotic pressure' is not a direct kinetic effect of the dissolved molecule. By whatever substance it be determined, it is to be thought of as due to directed oscillatory impacts of molecules of hydrone, equal in number to the number of active units of the solute (and of hydronol), at and about these units. It is to be regarded as rather of the order of hydraulic than of gaseous pressure.

16. At equilibrium, each active unit would be shadowed by a molecule of hydrone, as is each player, reciprocally, on the two sides by another in the game of *Lacrosse*. The hydrone molecules, therefore, would not be absorbed by the active units—i.e., fixed chemically. This is a consequence of my fundamental postulate. Of course, there might and would be constant interchange but the equilibrium would be undisturbed—so long as the conditions were unchanged.

17. This conception must be extended to other solvents in which no 'distributive' action is possible, which develop no special activity in the dissolved substance such as is produced on dissolving electrolytes in water. All solvents probably are to be regarded as mixtures of simple molecules with complexes formed by the association of several of these units. The proportion of simple molecules present must be a fixed one in every liquid and if equilibrium be disturbed by the fixation of the unit molecule by that of the solute the solution will be attractive of such molecules to the extent required to meet the deficiency.

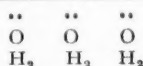
The problems of surface attraction are now being gradually brought under notice. It is worth while to consider these briefly, in connexion with the theory developed in this essay.

Prof. McBain has developed a beautifully refined method of determining the dew point, in studying the vapour pressures of soap solutions, in which he uses a highly polished silver tube, placed in a chamber above the liquid, changing the temperature of this until the point is reached at which dew is deposited. The difficulty of detecting the first very slight dimming of the surface is overcome by previously running boiling water through the tube and dipping the bottom angle on one side into boiling conductivity water. The water evaporates at once. No dew will form upon this part of the surface. Consequently, when the tube is viewed from the front, in making the determinations, the observation is facilitated by the appearance of a diagonal line of demarcation at the bottom angle.

Why is there no bedewing of the silver surface thus treated? Is it because of an insensible soiling, by a protecting, unwettable layer—or is it because the surface is made too nearly clean? Water, in my opinion, would not be deposited at a surface unless this were suitably enucleated—unless it bore particles of a potential electrolyte. The difficulty is to avoid the presence of these.

Glass, being composed of a salt, might offer nuclei: would 'pure' quartz or silver? Salt, according to Graham, does not attract hydrone, but sea-water does!

It is, however, conceivable that molecules of hydrone might hover at a surface, like a swarm of bees. I do not incline to regard an ethenoid union



as possible. This would involve combination with the surface—i.e., the occurrence of an electrolytic change: if such action were to take place, it would, I think, be followed by the distribution of the hydrone molecules at the surface, so that this would be hydrolated:



Hydrolation, apparently, is a necessary first stage of wetting. Once effected, however, this would be easily followed by a growth involving the formation of molecules of greater complexity—polyhydrone. Recent observations, by Davis and Eyre, seemingly lend support to the view, that the process of hydration is discontinuous and progressive. No one can say what may not be, nor exactly what is. We are lost in these higher regions of speculation and must await the results of carefully directed inquiry, carried on with an open mind and some regard to the large body of extant fact.

It may be well for me, at a later date, to discuss electrolytic change, as part of the general subject of chemical change, in the light of my recent communication to the Royal Society, as in this I have carried my views to a logical conclusion—so that my theory is now complete. The foundations for at least one headache are sufficiently laid in this present effusion.

Water has been so unconscionable a time upon my chest that, having let loose my feelings, my state is much like that of Mary Jane after Huck Finn had assured her that the nigger children would soon be reunited with their mother: I must be 'looking kind of happy and eased-up, like a person that's had a tooth pulled out.' Few would not rejoice to be rid of a toothache lasting over thirty-five years. Had I but roused myself and sought for the cure, I might long ago have found my panacea: only when I had indicted the Messel lecture did

I realise that the last step, that which counts, had yet to be taken—so 'I went to studying it out,' as Huck did his Mary Jane dilemma.

It is strange how slowly we see the obvious, how greatly we are afflicted with mental inertia, how rarely we compel ourselves to think out the solution of a problem. In a recent review of Mr. Santayana's philosophy, he is quoted as saying, 'I wish to retain the valuable testimony of the Indians to the non-existence of the obvious.' Mr. Santayana will have the whole-hearted support of most scientific workers. That which is obvious is last seen. The mental mechanism is easily clogged, only occasionally does it work freely but then usually in jerks: at times a very small thing will set it well agoing; evidently, some ripening process is in operation in the background. Side issues are a frequent source of inspiration—little or nothing is done without broad thinking: wireless signals are ever in the air and this or that stray message may easily be caught, if one be attuned to it—but it is easy not to be attuned, not to be listening-in even.

As to the solution I offer, my position is much like that in which Huck found himself:—

"I says to myself, I reckon a body that ups and tells the truth, when he is in a tight place, is taking considerable many resks, though I ain't had no experience and can't say for certain; but it looks so to me anyway; and yet here's a case where I'm blest if it don't look to me like the truth is better and actually safer than a lie. I must lay it by in my mind and think it over some time or other, it's so kind of strange and unregular. I never see nothing like it. Well, I says to myself at last, I'm agoing to chance it; I'll up and tell the truth this time, though it does seem most like setting down on a kag of powder and touching it off just to see where you'll go to."

The philosopher who wrote this must have had *Ionomania* and me in his subconscious mind. Remains to see what faith its credulous victims have left in them. . . . I can only say—let them all appear at the bar of public opinion or hold their peace for ever.

We have it from Sir Thomas Browne that—

"A cause of common error is the Credulity of men, that is an easie assent to what is obtruded or a believing at first ear what is obtruded by others. This is a weakness in the understanding, without examination assenting unto things, which from their Natures and Causes do carry no perswasion; whereby men often swallow falsities for truths, dubiosities for certainties, feasibilities for possibilities and things impossible as possibilities themselves."

Visit to the Widnes Alkali Works

AMONG the visits to works arranged in connection with the British Association, on Thursday, September 13, was one to the Pilkington Sullivan works, Widnes, of the United Alkali Company. There was also a visit by the Chemistry Section in combination with the larger party, which numbered 250. The Chemistry Section party was, however, taken around parts of the works of more particular interest to chemists. The company travelled by special train from Liverpool Central and were met by directors and members of the staff of the works. The official leaders were Sir Max Muspratt, Bart. (chairman of the United Alkali Company), Dr. G. C. Clayton, M.P., and Mr. R. Holden Davidson (directors). Dr. J. T. Conroy (chief chemist) and Captain F. W. Bain (for the British Association).

Certain of the new processes in the alkali industry are located at the Pilkington Sullivan works, which cover an area of forty-three acres. The general lay-out of the works, it was explained, rendered it desirable to confine the visit to the latest methods of brine electrolysis for the production of caustic soda and chlorine, of bleaching powder manufacture, and the preparation of organic intermediates for dyes and explosives in which chlorine has a part. The size of the plant and the possibilities of output were emphasised in their relation to the dye industry as an industry, and the outlet that that industry provides for the development of the heavy chemical trade. The visitors were undoubtedly impressed with the efforts made by the United Alkali Company to play its part in making the chemical industry of this country fit to cope with the many and complex demands of the present day.

The British Association Meeting at Liverpool

We give below abstracts of selected papers read before the Chemistry Section at the meeting of the British Association in Liverpool on September 14, 17 and 18.

The Nature of Enzymes

IN Section B (Chemistry) on Monday, Dr. E. F. Armstrong, F.R.S., opening a discussion on "Enzymes," said it was opportune that the subject should be stressed once again, because the study of enzyme action now resolved itself very largely into the study of surface effects, and he ventured to predict that the study of surface effects would be one of the most important tasks of the chemist during the next few years. He was gratified to find that the president of the section held the same view, as he had devoted so much attention to this subject in his presidential address. As regards enzymes, it was perhaps hardly necessary to say that enzymes were the catalysts found in plants and animals, which apparently enabled the plant and the animal very easily, at comparatively low temperatures, to bring about reactions which in the test tube required high temperatures and strong chemical reagents. Moreover, our recent knowledge of enzymes had taught us that they belonged to a class of substances known as colloids and, further, that their action was largely a question of surface action. The reactions brought about by enzymes were largely hydrolytic—i.e., they concerned active hydrolysis—if water was split off into HO-H , alternatively, they involved oxidation and reduction, which were only two phases of the same thing. In the latter case, water was split off into H_2O , so that the study of enzyme action was virtually a study of changes of water. Water was at once the simplest and the most complicated substance which the chemist had to deal with. All their studies came back in the end to the study of water, and therefore we must not neglect any possible alley of research into the properties of water, but must keep an open mind as to the behaviour of water and continually the processes of it, if we were to solve questions which were fundamentally at the bottom of the study of all natural processes.

Surface Action

He wished to remind them firstly of the manner of the preparation of an enzyme of animal or vegetable tissue. Yeast was a good example. The cell wall of yeast was broken in some way by drying it; then an aqueous extract was made of the enzyme, and the filtrate—the opalescent liquid—possessed properties which were attributed to the presence of an enzyme. Yeast extract, for example, would hydrolyse cane sugar. Apart from the fact that it was necessary to rupture the cell wall, and that this process produced changes in the cell, we had to consider the state of the enzyme in the opalescent solution. It used to be considered that the enzyme was truly in solution and was spoken of as a soluble enzyme, but he believed to-day the view was that we were dealing not with a true solution, but with a colloid gel. If we were dealing with a material of that kind, then we were justified in imagining that the action was taking place at the surface of the molecule—the molecule being a big one—and as we had gone farther in the study of enzymes we had discovered numerous cases in which we can get all the action required without having to dissolve the enzyme. Thus it was clear that enzyme action is a surface action.

The next stage we had arrived at in the investigation of the enzyme over a period of years was the manner in which enzymes act, as judged from the point of view of the rate of their activity. Physical chemistry in its application to natural problems had the advantage of bringing in exact science in the sense that it enabled us to make measurements. If the measurements came out all over the place, then we knew that our methods were wrong and the substances incompletely separated and impure. If, on the other hand, the measurements came out in conformity with some established laws, then we knew our measurements, so to speak, were satisfactory, and that we were dealing with substances which were more or less entities. He believed most of them were agreed that in the case of enzyme action, as in the case of other active catalysts, if the enzyme was really active and the solution such that plenty of material was brought to the surface all the time, then the rate of reaction was such that equal quantities of material were attacked—hydrolysed or oxidised, as the

case may be—in successive equal intervals of time. If this were accepted, then all idea of mysticism was removed from the action of enzymes, and it could be taken that when the conditions were ideal the rate of the action of enzymes was such that it could be expressed graphically, time against action, by a straight line.

If anyone present was thinking of embarking upon the study of enzymes, perhaps a word of caution might not be out of place, as the result of long experience. Enzymes, as active catalysts, were naturally extraordinarily sensitive to outside influences. A trace of alkali in particular, and acids to a less extent, affected very considerably their activity. Therefore it was practically essential that all such work should be carried out in hard glass beakers and flasks, and that solutions should be kept in hard glass bottles, and that pipettes and burettes should be of hard glass. Neglect of these precautions had led to many of the anomalous and complicated results to be found in the literature. If we regarded enzymes as colloids, then every possible means must be taken to keep the surface clean.

The Difficulties of Preparation

Referring again to the yeast extract, Dr. Armstrong said that the best way to make a very strong enzyme from yeast was to put some ordinary brewer's yeast in a bottle with a little toluene on the top, and place it in an incubator at 36° for a week or more. The result would be a dark brown liquor, which, after filtering, was a thick opalescent liquor, although a very dark solution. By the cautious addition of alcohol this could be precipitated into a brownish whitish slime, a sort of colloidal substance which, after washing with alcohol, could be quickly re-dissolved in water. This gave a much cleaner solution, highly active and hydrolysing. If that process were repeated with care a dozen or more times they would get less and less material and the activity increased. They would then begin to amuse themselves with test tubes on ordinary organic groups, and would find, as the purification was carried farther and farther, that the reaction with sugar grows fainter; the reaction with amino acids and protein bodies would grow fainter, and, in fact, nearly all the reactions would grow fainter. Generally, in any one series of experiments all the reactions disappeared except one, and the experimenter probably would think that he had made a discovery as to the destruction of enzymes, and would probably publish a paper. But if the experimenter had had more experience he would do it all over again, and would find that the reaction which did not disappear at the first attempt disappeared at the second, and that one of the other reactions proceeds, and if this were done several times the experimenter would decide not to publish a paper. (Laughter.) The only conclusion to be drawn from work of that kind was that purification was haphazard, and from his own point of view he was quite clear that it was impossible to purify the enzyme because there was no such thing as an enzyme in the sense that there was, say, a molecule of cellulose. It seemed to him that it was highly improbable that there was such a thing as an enzyme, and that what he had was a big colloid surface, and that one part of it contained a certain grouping which, when under the proper physical conditions, was able to act as a catalyst, and possessed the activity with which was associated the name, enzyme. He hoped that his physical-chemical colleagues would devote much attention to the study of this peculiar and particular surface condition which brought about this state of high activity. What chemists wanted to know was what particular groupings existed for each specific enzyme action. All we knew at the moment was that there was some definite relation between the activity of the enzyme and the substance on which it acts. Each particular enzyme restricted its action to nearly one subject. Fischer had studied the action of enzymes particularly in relation to the sugar molecule, and from that work we knew there must be the closest connection between the structure of the glucose and the activity of the enzyme. Fischer suggested the analogy of the lock and key, which was rather an unfortunate one from our present-day point of view, because it did not

correlate itself with the ideas of surface action at all. Langmuir imagined that when they had a fatty acid on water, they had oxygen bringing a carboxyl group on to fatty acid, on to the surface of the water, and that the rest of the molecule reared itself proudly in the air. Langmuir's original suggestion seemed to have found favour very generally. It was dealt with in an exceedingly illuminating way in the Presidential Address to Section B, and Hardy had studied it a great deal farther. When one brought two pieces of glass together with an organic liquid between them, there was a great tendency for the chemical molecules to arrange themselves in a definite orientation and all our space lattice theory in the structure of metals fitted in with this new conception. Now we could take our sugar molecule and arrange it at the surface of the colloid, orientated after the manner suggested by Langmuir, and completing an electro-chemical circuit whilst the action took place.

As regards the nature of the first phase of the reaction between the substance attacked and the enzyme, there were two rival theories at the moment. The first was that some kind of complex was formed between the enzyme and the substance which it attacked, and that the forces which brought about the formation of that complex were chemical forces. The physicists held the view that this active layer of colloid was able to adsorb or absorb the substance, the forces holding it being physical. The work of Hardy had shown that this adsorbed layer was generally one molecule thick, or not very much more. The only difference was the view in the one case that the forces were chemical, and in the other case that they were physical, but he thought there was very little doubt that both meant the same thing although they were expressing it differently.

It was not possible to offer such proof in the case of enzymes, but it was possible to offer it in the case of other catalysts. In the case of other catalysts, particularly nickel, there was convincing proof that such a complex was formed. He had been able to isolate three other substances besides the one he had started with in carrying out the simple reaction of the reduction of oleic acid in the presence of a nickel catalyst. If they added to that the extraordinary relation between the structure of sugar, then he thought the evidence was absolutely in favour of the formation of a definite chemical complex between the enzyme and the substance on which it acts.

The next stage of the process was the operation of hydrolysis, but there he could not go any farther at present. He hoped many workers would tackle that problem, viz., the source of the energy which caused the hydrolysis or oxidation or reduction. When this complex had been established, it would look as if the formation of it was necessary for the formation of an electro-chemical circuit where the energy was started by radiations or by the ultra-violet light, on which Prof. Baly was working. This could not be said at present, and it was going to be a very fruitful field for very important research.

A discussion followed, to which Dr. Armstrong, in replying, said the important enzyme question was that of synthesis. It had been asked whether enzymes affected synthetic action, and the answer was in the affirmative. It had further been asked whether enzymes synthesised the same material as they hydrolysed. His answer to that was that he wished he knew. Prof. Baly said they did and the French people said they did, but personally he had never been able to get any evidence in the affirmative, although he had tried over and over again for 20 years. In the test tube, we were unable to realise the conditions which took place in nature. Probably in nature the enzyme could act reversibly, but in the test tube there was no favouritism. Every possible reaction took place and there would be synthesis of both forms; but the balance would lie in favour of the one which was ordinarily not destroyed, and we should tend to get not the natural but the isomeric form synthesised. The subject was not one per cent. so simple as he had attempted to make it in his earlier remarks, and there was a great deal of very difficult organic work to be carried out before we should get very far. Professor Robinson had thought that polymerisation might help from that point of view, but there was one point which had not been emphasised sufficiently, and that was that this complex was frightfully unstable, and that was an important matter in relation to any further development of the subject from the point of view of the quantum theory. Energy must come in some way to account for the rapidity with which the enzyme is renewed and ready for action again.

Sulphonation & Nitration of Naphthalene

PROFESSOR H. E. FIERZ read a paper on the above subject before section B of the British Association on Tuesday. Much of the published work was contradictory, he said, but the most valuable work ever done in the field of the chemistry of naphthalene was certainly the one by Armstrong and Wynne, who established the law that by the interaction of naphthalene and sulphuric acid there are never obtained derivatives containing sulphonie groups in ortho-para or peri-position. This law holds good in every case which has been carefully examined, and statements contrary to this law have been found to be incorrect and devoid of foundation.

Armstrong and Wynne did not state clearly whether they observed that on treating naphthalene with fuming sulphuric acid derivatives were obtained containing two sulphonie groups in one benzene nucleus, but Dr. Fierz's work led him to the belief that the substitution of naphthalene with two sulphonie groups invariably gives disulphonie acids containing the acid groups in the two benzene nuclei and never in the same. This fact had always been silently accepted, but he had found that in this field it was never safe to accept anything unless it was positively proved, and although this observation seemed at the first glance of no importance, it had nevertheless hindered the chemist to get a clear view of a field which was of great importance in connection with synthetic dyestuffs, in particular the azo-colours. The technical chemist interested in his work was not satisfied to know that a compound was formed; he wanted to know how much there was obtained, and he was also interested to find out what had become of the rest, which was perhaps the cause of the unsatisfactory yield. Unless one knew what had become of the rest, no technical process could be regarded as satisfactory, however large the profits which might be obtained through favourable commercial circumstances. With this in view he had undertaken a series of researches still going on, but which in a way might be regarded as closed at present. The method of investigation consisted in preparing the pure free acids by decomposing the barium salts with the calculated amount of sulphuric acid. Having done this he prepared a great number of salts, studying their solubility, and from the data obtained in this way proceeded to separate the mixtures choosing the most suitable salts. In most cases it was found that the free sulphonie acids in the naphthalene series are most beautifully crystallised substances which are non-deliquescent, and which are, contrary to the statements found in the scientific literature, very easily prepared.

The Products of Sulphonation

Monosulphonation.—At temperatures below 40° with a quantity of sulphuric acid being just sufficient to sulphonate the naphthalene once, there is formed 96 per cent. of 1-acid and 4 per cent. of 2-acid. This mixture is to be regarded as an equilibrium and the proportion of 1- and 2-acid changes according to the temperatures, but it is impossible to obtain pure 1-acid or pure 2-acid by simply altering the conditions of the reaction.

Disulphonation.—On treating pure naphthalene with sulphuric acid containing just enough anhydride (SO₃) to obtain disulphonie acids, the following isomerisms are readily established. At temperatures under 40° C. there is obtained a mixture containing 70 per cent. of 1,5 disulphonie acid and about 25 per cent. of 1,6 disulphonie acid, and probably a little 2,7 disulphonie. It is very easy to show that the amount of 1,5 disulphonie acid reaches 70 per cent. because its barium salt is practically insoluble in water, hot or cold, and separates immediately on mixing the boiling solution of the sodium salts of the different isomerides. At temperatures between 120 and 135° the 1,5 acid gradually disappears and a new disulphonie acid makes its appearance. It is again quite easy to show that this new acid is the 2,7 naphthalene disulphonie acid. Not a trace of 2,6 acid can be detected.

Raising the temperature to 140° C., the 2,6 acid makes its appearance, being readily identified by its barium salt, which curiously enough is characterised exactly like the 1,5 salt by a surprisingly small solubility. The facility of identification of the 2,6 barium salt makes it very easy to show that a statement of Ebert and Merz to be found in every textbook for fifty years past is devoid of foundation, namely, that at a temperature of 180° C. the 2,6 acid is the sole product. Personally, he had not been able to find more than 30 per cent. of the

2,6 acid. Experiment showed that at a temperature of 165° C. there is always formed, in round numbers, a mixture of 24 per cent. 2,6 acid, 10 per cent. of 1,6 acid (or more) and 65 per cent. of 2,7 acid (or less). No other acid could be identified, and it is impossible to obtain one isomeride as the sole product of the reaction. The amount of free SO₂ necessary to obtain quantitative disulphonation depends naturally on the amount of concentrated sulphuric acid present; and taking two parts of 100 per cent. sulphuric acid and one part of naphthalene, disulphonation proceeds quantitatively at 165° C. in the course of three hours.

Trisulphonation.—According to the Armstrong-Wynne rule, there can be formed only three different trisulphonic acids of naphthalene, but only one of them is of great technical importance, viz., the 1,3,6 trisulphonic acid. The two other trisulphonic acids, one derived from 1,5 and the other from 2,6 disulphonic acid, are still under investigation. Both are readily transformed into the identical and sole tetra-acid, viz., the 1,3,5,7, or the 2,4,6,8 tetra-sulphonic acid. Thus it had been found that Armstrong's rule holds good in every case where the system naphthalene—sulphuric acid is involved, and the innumerable isomerides which seem to be obtained at first are reduced to a small number of individuals.

The Products of Nitration

The nitration of naphthalene gives rise to two isomerides, viz., the 1- and the 2-nitronaphthalene. Unlike the acids, there is no change from one into the other, and the sole similarity between sulphonation and the nitration consists in the fact that in many cases nitration at higher temperatures leads to the formation of more or less 2-isomerides, without it being possible for the present to give satisfactory numbers. The derivatives are mono and dinitro compounds. In many cases a great proportion of 2-nitrocompound is formed, which invariably is distinguished by its greater solubility, appearing therefore in the mother liquors. There is always formed more than one derivative, at least two, often three or more, and the separation is not always easily effected. The best known nitrosulphonic acids are the 1,5, the 1,8, the 1,6 and the 1,3,6,8 trisulphonic acid. But there our knowledge practically ends. He had been able to show that nitration never proceeds quantitatively and that as a rule the 10-40 per cent. escapes nitration.

The reduction of the different nitro-acids is not always a reaction which proceeds smoothly. The 1,5, 1,8, and the 1,4,8 and 1,3,6,8 amino-sulphonic acids are very readily obtained, but in other cases matters are not so simple. The yield, for instance, of the naphthylamine-disulphonic acid 1,3,8 never exceeds 43 per cent., besides 15 per cent. of the so-called Andresen acid (2,4,7 naphthylamine disulphonic acid). In the mother liquor there remains invariably about 42 per cent. of unknown acids which cannot be purified on a small scale. The same fact applies to the preparation of the important Cleve-acids, 1,6 and 1,7, both of which are only obtained in a very unsatisfactory yield never exceeding 65 per cent. of the theoretical. He had investigated this particular case in detail and had been able to show that three distinct factors determine the yield.

First of all, it is not possible to nitrate the mixture of 85 per cent. 2-acid and 15 per cent. 1-acid quantitatively, but about 10 per cent. escapes nitration. By raising the amount of nitric acid, dinitro-acids are formed. Secondly, the reduction of the Cleve-acids is very sensitive towards free acid; the hydroxylamine derivatives which are formed as an intermediate product are only reduced with difficulty, changing at the same time readily to aminonaphthol-sulphonic acids which cause the rapid oxidation of the Cleve-acids obtained. Thirdly, the mixture of the four different naphthylamino-sulphonic acids, together with the amidonaphthol and the β-acid unchanged, gives rise to a kind of colloidal solution from which the amino-acids separate only very slowly, in spite of their great insolubility.

The Quantum Theory in Chemistry

PROFESSOR G. N. LEWIS, of the University of California, in a paper on "The Quantum Theory in Chemistry," which was read on Friday, September 14, said that the establishment of the quantum theory in physics and chemistry was producing one of the greatest revolutions in the history of thought, and, whatsoever might be its metaphysical implications, there was

no doubt that it corresponded better with experimental observation of nature than the existing classical theories. The latter regarded the processes of nature as being continuous, and to be interpreted by an infinitesimal calculus, but the quantum theory went back to the older and simpler methods of counting in measurable units. The new theory of discontinuity had come gradually but with increasing velocity, and was due in every case to the fact that the classical theories failed to correspond with experimental results which could be easily explained on the supposition that all action took place by measurable jumps or accretion of units.

Dalton's Atomic Law was the first step, and was followed by the conception of electricity being composed of electrons by the failure to explain the spectrum on classical thermodynamical principles. In chemistry the theory presented itself in the form that a molecule remained in a state of quiescence until it received certain measurable quanta of energy. He was prepared to lay down the general principle now that every molecule, simple or complex, was stable until it was raised to a higher energy level by the input of definite quanta of energy.

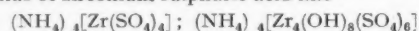
The Periodic Law and Hafnium

DR. D. COSTER, in a contribution on "High Frequency Spectra and the Theory of Atomic Structure," on Friday, September 14, said that recent researches had revealed that some peculiarities of the periodic table find expression in the X-ray spectrum. If Moseley curves are plotted not for the lines themselves but for the spectral terms,* we observe, at different stages sudden changes in the slope of the curves. These irregularities corresponded with regions of the periodic table, according to Bohr; an inner group of electrons was being completed—i.e., in the neighbourhood of the iron group, the palladium group, the platinum group, and in the case of the rare earth metals. Recently X-ray spectroscopy had led also in a more direct way to a confirmation of the Bohr theory. According to Bohr, the element of atomic number 72 should not belong to the rare earth metals, but must be a homologue of zirconium. This conclusion of the theory was verified by the discovery of hafnium.

Dr. G. Hevesy, speaking next, said that though hafnium is to be placed in the periodic table between zirconium and thorium where formerly cerium happened to be placed, its chemical properties are not intermediate between those of zirconium and thorium, but much nearer to the former element.

While the fluorides and double fluorides of thorium are practically insoluble, the corresponding zirconium compounds, and still more the hafnium compounds, are fairly soluble in cold, very soluble in hot water. By this method zirconium can easily be separated from hafnium. The mineral is melted with KFHF, and by crystallising the potassium double fluorides the hafnium concentrates in the mother-liquor. Most of the preparations exhibited have been obtained by this method.

Hafnium oxalate is, like zirconium oxalate, soluble in an excess of oxalic acid. The oxychloride of hafnium is less soluble than zirconium oxychloride. When crystallising compounds of zirconium sulphuric acid like



hafnium concentrates in the mother-liquor. Hafnium is more basic than zirconium; accordingly the latter is more easily precipitated by ammonia, sodium thiosulphate, etc.; and while zirconium sulphate begins to decompose above 400°, the temperature at which hafnium sulphate undergoes a marked decomposition lies about 100° higher. Thorium phosphate is easily dissolved by strong mineral acids, zirconium phosphate much less, whereas hafnium phosphate is found to be still less soluble. The close relationship of zirconium and hafnium is also clearly exhibited by the fact that zirconium extracted from different minerals always contains ½-30 per cent. hafnium, while in none of the typical thorium minerals could hafnium be detected. We must conclude that the zirconium, hitherto thought to be an element, was a mixture of two elements, of zirconium and hafnium.

* Every line frequency may be represented by the difference of two terms, each of which corresponds with the energy of the atom in one of its stationary states.

The Oxidation of Metals

MR. W. C. PALMER read a paper before the Chemistry Section on "The Oxidation of Copper and the Reduction of Copper Oxide by a New Method," on Monday, in which he described how he had overcome some of the difficulties with which a determination of the rate of oxidation of metals was beset. If a relatively large quantity of massive metal were used the experiments were very prolonged, owing to the difficulty of oxidising the metal, and it was not easy to maintain the pressure of the oxygen constant during an experiment. On the other hand, if finely powdered metal, formed from oxide by a reduction process, be used, the local heating during oxidation was so intense that measurements of temperature of the reaction were quite illusory. Moreover, the rate of diffusion of the oxygen into the metal was probably a determining factor in the rate of oxidation under such conditions. These difficulties, however, had been surmounted by the use of a method which he described, in which the rates of oxidation of a film of copper about 0.001 mm. thick (and of the reduction of the oxide formed from this copper) had been followed continuously by observations of the changing electrical conductivity of the film.

Preparation and Use of the Apparatus

A film of copper oxide was prepared on a china clay rod, 3 mm. in diameter and 3 cm. long, which had finally to be reduced to metal. This reduction could not be effected at low temperature (150° to 250° C.) by simply bringing reducing gas (carbon monoxide or hydrogen) into contact with the heated film, but it might be brought about in either of the following ways: (1) The prepared rod, coated with oxide, is heated to 250°–300° C. in a stream of carbon monoxide; no reduction occurs; but when suddenly chilled to 150° C. in another bath, the oxide is easily reduced to metal. (2) The rod is heated to the desired temperature of reduction in a tube. The tube is then exhausted to 1 mm., filled with nitrogen, and the rod is kept at 150° C. for about one hour. On again exhausting and admitting carbon monoxide, reduction occurs almost instantaneously. (3) The rod is heated to redness for a few minutes in a tube exhausted to 1 mm. It is then allowed to cool to 150° C. or other temperature desired for reduction, and carbon monoxide admitted; reduction occurs instantaneously. In all cases the carbon monoxide must be thoroughly freed from air. This can conveniently be done by allowing the gas to stand in contact with the usual alkaline pyrogallol solution. The gas need not be dry.

The special procedure described, said Mr. Palmer, was directed towards two objects, (1) the removal of the oxygen adhering to the oxide-film and rod, (2) the formation of nuclei of metallic copper by the action of minute particles of organic dust that must adhere to the rod when placed in the reduction apparatus. The absence of oxygen and the presence of copper were both essential if reduction was to be effected. All the above methods of reduction were used in different experiments, but they all led to a copper film of identical chemical properties as regards oxidation. The copper remained untarnished in air for some hours. The carbon monoxide was prepared by heating 80 per cent. sulphuric acid with anhydrous formic acid. The copper on a typical film was estimated by the usual calorimetric method, with ammonia to weigh 0.0023 gm., and from its dimensions this would imply a thickness of about 1/1,000 mm. By the use of two silver clamps attached to each end of the rod, the film was brought into electrical contact with the circuit carrying the current by which its resistance was measured. Other forms of silver contact were tried without changing in any appreciable way the measured rate of oxidation.

The copper film so supported was placed in an electrically heated tube, which could be exhausted by the Töpler pump, and was connected to a manometer and a supply of pure dry oxygen. The current, by the variation of which the resistance of the film was measured, was developed by two thermocouples of copper-constantan, one in boiling ethyl benzoate (213 deg. C.) and the other in ice. A small current is essential to avoid independent heating of the film and also to reduce to a minimum any possible action of the current upon the course of the oxidation. The resistance was measured by calibrating a millivoltmeter in the circuit against a known resistance, so that a reading on this instrument corresponded to a known resistance in the circuit.

The Effect of Reducing Gases

Before proceeding to a measurement of oxidation and reduction by this method, the author investigated whether (1) the conductivity is really a measure of the metallic content of the film, (2) the current influences the course of the reaction and (3) the process of oxidation or reduction *per se* influences the conductivity. The result of his work generally was to prove that the rate of oxidation of a copper film of about 0.001 mm. thick could readily be found from observations on the increasing electrical resistance and that, similarly, the rate of reduction of oxide can be followed by observing the decrease of resistance. Such a film conducts electricity normally, but is sufficiently thin for the effects of gaseous diffusion to be absent. Mixtures of reducing gas (such as carbon monoxide or hydrogen) with oxygen, when brought into contact with copper at 250 deg. C., oxidise the metal more rapidly than does pure oxygen. This effect is very marked, even when equal volumes of reducing gas and oxygen are used. The reduction of copper oxide by carbon monoxide or by hydrogen at low temperatures takes place only in the presence of copper, and the rate of reduction is simply proportional to the amount of metal present. When hydrogen is used for reduction, the water formed acts as a negative catalyst, and the reduction is soon brought to a standstill unless the water is removed by exhaustion. The author added that attempts to explain the effects described above are greatly aided by the simplicity of the reactions concerned.

Cohesion and Molecular Forces

ON Thursday, September 13, a general discussion was held on Cohesion and Molecular Forces between Section A (Mathematical and Physical Science), Section B (Chemistry) and Section G (Engineering). Sir William Bragg, F.R.S., who opened the discussion, said that it was essential to get down and know the nature and effect of cohesion as between atoms and molecules themselves. Recent investigation went to show that each atom did not act as a whole but acted at a number of different points on its surface and that the forces which were exerted had an extremely small range. Therefore we must think of molecule acting upon molecule and building up just in the same way as a girder structure was built up, and it was only by thinking in that way that a movement in the direction of true investigation could be made to find out what were the real forces acting between the individual atoms of the molecule.

Dr. W. Rosenhain, F.R.S., said that metallurgists had an advantage in this matter in that they were able to deal with the simplest kinds of solid bodies, which were monatomic in constitution. The results obtained with crystal analysis had enabled consideration to be given to a single atom, and this had also enabled us to go a step farther and realise the effects which would result in a space lattice consisting of individual atoms of a metal when certain of the atoms were replaced by similar or stronger atoms. This was the more important in the case of metals because cohesion phenomena was much more strongly marked in metals than organic salts or several of the inorganic salts. The closeness with which atoms approached each other had an enormous influence upon the behaviour of metals in subsequent working and therefore it was essential to know the conditions which permitted of the atoms bonding themselves together more closely or less closely. He put forward the suggestion that the forces applied at the crystal boundary were greater than in the crystal itself. His main point was that a detailed knowledge of metals and alloys, together with the wonderful light which had been thrown upon the structure of the crystal by X-ray analysis, was enabling us to form a clearer picture of the internal mechanism than had hitherto been dreamed of.

Dr. A. A. Griffith said that the branch of engineering which was most intimately concerned with the phenomena of cohesion and inter-molecular force was the science of elasticity and strength of materials. Whilst the majority of structural metals were ductile and the primary failure did not involve atomic separation at all but was a failure in shear, nevertheless, in the case of certain materials, such as glass, stone and hard steel, which exhibited brittle fractures running perpendicular to the direction of greatest tensile stress, the shearing type of failure did not occur at all. A large discrepancy apparently existed, inasmuch as the tensile strengths were only a small fraction of the molecular tenacity. Thus,

in the case of a dead hard steel, the applied tensile stress necessary for fracture was only about 160,000 lbs. per sq. in., while the cohesive forces to be overcome in order that fracture might occur corresponded with a tensile stress of the order of 4,700,000 lbs. per sq. in. He thought the difficulty could be resolved by the hypothesis that the material contained minute cracks or flaws, and according to this theory fracture was due to the very severe concentration of stress at the corners.

Professor E. Rutherford, F.R.S. (President of the Association), thought it was the only way, in order to get at the facts and information required by engineers, to do as Sir William Bragg had suggested, and investigate the individual atom. He

had always thought that the most hopeful line of progress was on the hypothesis of the elastic deformation of single crystals, because we wanted to know what are the forces between the individual atoms. It seemed to him it ought to be possible to get some definite information of that nature by working on a very simple case to start with.

Among those who contributed to the discussion was Sir Henry Fowler (President of Section G), who said engineers wanted to know why structures and materials did occasionally break, although it was equally interesting to know, as Sir Oliver Lodge had said, why when one lifted the end of a stick the other end also came up.

Dye Standardisation in the United States

We publish below the substance of the Memorandum of the Bureau of Standards on the standardisation of dyes in the United States.

I—Need for Standardisation

THE lack of uniformity of commercial dyes in colour, strength, quality, and money value is well known to the trade. Before the war the dye industry was controlled by the German firms, who maintained a multiplicity of names, strengths, and qualities of dyes. The trade was accustomed, therefore, to dyestuffs of variable quality, so that when the field was opened to American manufacturers opportunity was presented for the wholesale adulteration of textile colouring matters by jobbers and brokers, whose profits entailed a corresponding loss to legitimate industry. The demand for standardisation has come mainly from the dyers and textile manufacturers who believe standardisation will remedy this objectionable condition.

The situation with respect to the enforcement of the standardisation features of the Tariff Act of 1922, clearly shows that there was little or no standardisation in the past, and that it is needed now. The standardisation of dyes is in accord with modern business practice whereby buyer and seller have a common basis of knowledge of the products of trade. Such practice leads to more economical business, and better business to legitimate industry. The manufacturer of dyes in particular is coming to see the advantages of standardisation. In fact, standardisation may well become a distinctive feature of the American dye industry.

II—The Problem

The problem of dye standardisation is first to devise methods for: (1) Identification of dye species. (2) Determination of colour strength in terms of pure dye content or some arbitrarily chosen standard. (3) Determination of quality of a dye; this includes fastness tests, and tests for suitability of a given product for a special use. Then the problem is to establish standards and specifications for each dye which will be acceptable to manufacturer and consumer.

III—Plan of the Work

1. *Identification.*—It is believed that spectrophotometric analysis coupled with group reactions will be sufficient for the identification of dye species.

2. *Colour Strength.*—Methods will be developed for the quantitative determination of the organic and inorganic constituents of ordinary commercial dyes. Particularly the various chemical and physical methods for the determination of pure dye content and colour strength will be studied and compared with the ordinary dye testing method, and whenever practicable these results will be compared in turn with actual dyeing in the mill. It is anticipated that no one method of evaluation will be found generally applicable, and that for purposes of standardisation the most desirable method will have to be specified for each dye.

3. *Quality.*—The evaluation of the quality of a dye will offer difficulties because of the variety of uses and demands made upon each dye species. Standard specifications for fastness tests must be drawn up. It may be desirable in some cases to prepare a set of standard samples of dyes which exhibit the degrees of fastness indicated in the specifications in sufficient quantity to supply samples to the industry.

4. *Work to be Undertaken First.*—Some work has already been done. With this work as a background it seems advisable to undertake immediately the standardisation of the following listed colours.

Direct Dyes.

Schultz No. 462 Direct deep black EW.
337 Benzo blue 2B.

476 Benzamine brown 3GO.

463 Erie direct black RX.

333 Oxamine black BHN.

Acid Dyes.

Schultz No. 217 Agalma black 10B.

145 Orange II.

700 Nigrosine, water soluble.

877 Indigo extract.

23 Tartrazine.

Mordant and Chrome.

Schultz No. 181 Salicine Black U.

89 Metachrome brown B.

48 Alizarine Yellow G.

Basic Dyes.

Schultz No. 284 Bismarck brown R.

33 Chrysoidine Y.

515 Methyl violet.

Vat Dyes.

Schultz No. 874 Indigo.

842 Indanthrene blue GCD.

763 Indanthrene dark blue BO.

Sulphur Dyes.

Schultz No. 720 Sulphur Black.

These dyes are selected because they include over 50% of the poundage of dyes manufactured in the country and over 33% of the money value of dyes manufactured. Each is produced by a relatively large number of manufacturers. They represent the principal groups of dyes both as to application and chemical structure. In general, standardisation of these dyes will bring out all the difficulties involved and will be a big step forward in the standardisation contemplated.

5. *Detailed Plan.*—Standardisation of each dye will be effected in the following steps:

1. Preparation of a relatively pure sample of the colour of known purity.

2. Comparison of a series of samples from all American manufacturers and from other sources, with this sample by the various analytical methods.

3. Determination of the variation in quality of the series.

4. Acquire a large sample, say 10 lb. to 20 lb., of satisfactory quality to be called the standard.

5. Write specification for the dye indicating: (1) Method of identification; (2) methods of analysis; (3) its quality, fastness, etc., in terms of standard tests; (4) allowable variations in the product.

6. Arrange for the distribution of the specifications and of samples of the standard to those interested, and urge buying and selling of the dye on the basis of the specifications.

7. Other problems: Many subsidiary problems of methods of analysis and properties of dyes will have to be solved as the work progresses. Considerable data of more purely scientific interest regarding the physics and chemistry of dyes and dyeing will undoubtedly be obtained in the course of the work. This type of work may be pursued further as time permits.

IV—Facilities

1. *Chemistry Division.*—There is at present one laboratory of about 18 by 20 ft. in size, devoted to dye work. In addition, there is office space and storage room. The laboratory is equipped with about 115 square feet of laboratory desk containing cupboards, drawers, etc. There are two hoods and the usual laboratory connections for hot and cold water, gas,

compressed air, vacuum, distilled water, electricity, etc. There is an Eimer and Amend electric centrifuge and a large Freas electric vacuum oven. A titanous chloride titration outfit is in working order and apparatus for electrometric titration is available if needed. We have a solid copper dyeing bath holding six dye cups and a small air-bath for dyeing skeins. The usual laboratory glassware and chemicals are, of course, available. We have a collection of about 100 large samples of commercial intermediate and some purified materials. Our dye collection includes perhaps 1,200 samples, among them many pre-war samples. The U.S. Tariff Commission has deposited with us the Textile Alliance Collection of German standards.

2. *Colorimetry Section*.—The dye work at the Bureau of Standards is an outgrowth of the work of the Colorimetry Section of the Bureau on the standardisation of colours by spectrophotometric methods. The colour of a dye in solution, or upon fabric, can be fundamentally specified only by the spectral transmissive or reflective properties respectively—measurements which this section is undoubtedly better qualified to make than any other laboratory in the country.

3. *Textile Section*.—The Textile Section of the Bureau of Standards is vitally interested in dyes from the standpoint of their application to and behaviour on the fibre. This section is equipped with apparatus for testing the physical properties of fabrics and is installing apparatus for the dyeing of hosiery in 5 lb. to 10 lb. batches. Researches on the methods of application of dyes to hosiery, relative values of dyes from various sources, and effects of dyes on the physical properties of the material are being undertaken in co-operation with an association of hosiery manufacturers. It is believed the co-operation of the Textile Section will greatly facilitate the work on dye standardisation.

V—Work Already Accomplished

The following listed dyes have been prepared from recrystallised intermediates by methods which should give products free from insoluble matter and which should contain moisture and salt as the chief organic diluents. Although not of the highest purity, they should be reasonably free from organic contaminating substances.

Schultz No.

- 7 Naphthol yellow S
- 9 Direct Yellow
- 23 Tartrazine
- 33 Chrysoidine Y
- 34 Chrysoidine R
- 37 Croceine orange
- 38 Orange GG
- 48 Alizarine yellow G
- 57 Chromotrope 2B
- 58 Alizarine yellow R
- 61 Victoria violet
- 68 Spirit yellow R
- 73 Helio fast red
- 79 Xylidine orange 2R
- 82 Ponceau 2R
- 134 Metanil yellow
- 138 Methyl orange
- 139 Orange 1V
- 145 Orange 11
- 161 Fast red A
- 163 Azo Rubine
- 166 Fast red E
- 168 Amaranth

Schultz No.

- 169 Cochineal red
- 173 Lithol red
- 177 Mordant yellow
- 217 Agalma black 10B
- 227 Brilliant Croceine
- 284 Bismarck brown R
- 303 Paper yellow
- 307 Congo red
- 333 Oxamine black BHN
- 337 Benzo blue 2B
- 343 Diamine fast red
- 344 Diamine brown
- 363 Benzopurp 4B
- 426 Benzamine pure blue
- 462 Direct deep black EW
- 463 Erie direct black RX
- 474 Oxamine green B
- 476 Benzamine brown SGO
- 477 Congo brown G
- 495 Malachite green
- 576 Crystal violet
- 649 Meldola's blue
- 659 Methylene blue

Moisture and chlorine determinations have been made on these preparations and the spectrophotometric constants for the dyes in solution have been measured. A series of six samples of chrysoidine Y and 2 and chrysoidine R have been compared chemically, by titanous chloride titration, and spectrophotometrically with the laboratory preparations. It remains to correlate these data with dyeing tests. A series of samples of crystal violet from the American manufacturers have been compared with a laboratory preparation and with a pre-war Badische sample. This work was undertaken at the request of a committee of moulding sand users in order to find a product suitable for the determination of colloidal matter in moulding sand.

An Improved Methyl Orange

In a paper read recently by Mr. James Moir before the South African Chemical Institute it was pointed out that owing to the change of colour of methyl orange being much less in artificial light than in daylight, for those who have to use this indicator without daylight, two remedies have been suggested, viz.:—(1) Use of lamps of blue glass or "Daylight" lamps, and (2) addition of a blue dye to the methyl orange indicator.

Now methyl orange has a number of special technical uses which render it indispensable in a laboratory, no other easily obtainable indicator being capable of taking its place. ("Bromophenol-blue" can, of course, take its place, but is expensive.) It was therefore thought worth while to see if methyl orange could be modified by substitution, so as to improve its colour and yet preserve its essential property of only changing colour with definite acidity, viz., at a hydron-concentration of $N/10,000$ at least.

Methyl orange is *p*-sulphobenzeneazo-dimethylaniline. The following modifications were tried: (a) Replacing sulphanilic acid in the manufacture by (1) alphanaphthylamine, and (2) naphthionic acid; (b) replacing dimethylaniline by dimethylalphanaphthylamine. These modifications were successful in producing indicators with the required deep colour and correct range of hydron-concentration, but the products were too insoluble in water.

The suggested new indicator is a combination of the methoxyl and naphthalene ideas. It is *p*-sulpho-*o*-methoxybenzeneazodimethyl-alphanaphthylamine. This is sufficiently soluble in water, and changes from orange to blue violet with acid in daylight (from deep yellow to red purple in artificial light).

The range of pH over its change is from 4.9 to 3.5, whereas that of methyl orange is 4.1 to 2.8. It is insensitive to CO_2 by artificial light, although it shows a minute change with CO_2 by daylight.

To make the indicator, commercial *o*-anisidine is heated for 10 minutes with 4 parts of common strong sulphuric acid at 120–130° C. The cooled product is poured into water and nearly neutralised with sodium carbonate until the acidity is slight (taste is a sufficient test). The liquor is treated with 5 per cent. sodium nitrite solution (calculated on the original anisidine) until a moistened starch-iodide paper reacts one minute after the nitrite has been added. (Diazotisation is not instantaneous owing to "protection.") The theoretical quantity of dimethyl-alphanaphthylamine is dissolved in 50 parts of alcohol and mixed with 20 parts of saturated aqueous sodium acetate solution, and the diazo solution added all at once. Sodium carbonate is gradually added until the mixture is nearly neutral, when the indicator crystallises out from the acidic solution as a powder with a green metallic lustre. Dimethyl-alphanaphthylamine is made by shaking naphthylamine (in an indifferent solvent) with excess of methyl sulphate and caustic soda.

Working to first change, the new indicator gives the alkalinity of local tap-water as $13\frac{1}{2}$ $CaCO_3$ per 100,000, as against 14 by methylorange. This is a severe test of its similarity to methylorange. It gives identical results with larger quantities of alkali.

Award of the Priestley Medal

THE Priestley medal, awarded every three years by the American Chemical Society for distinguished services to chemistry will be bestowed upon Dr. Ira Remsen, President Emeritus of Johns Hopkins University, at ceremonies in Milwaukee, Wisconsin, on September 12, in connection with the annual meeting of the society. Dr. Remsen, who is 77 years of age, was born in New York City and was graduated from the City College in 1865 and from the Medical School of Columbia University in 1867. From 1901 to 1912 he was President of Johns Hopkins. He is a Ph.D. of the University of Göttingen and is a past-President of the American Chemical Society and has been honoured by learned societies.

The Production of Rubber Latex

RUBBER latex made its initial appearance among the British Malaya exports for June last year. It is now reported that within the thirteen months to the end of June this year the exports amounted to 97,015 gallons, value £18,973. About 72,400 gallons came to Great Britain, 20,790 gallons were transported to the United States, 2,468 gallons to Europe, 720 gallons to British dominions and 626 gallons to Japan.

Oil as a Cause of Oxygen Explosions

Investigation by the U.S.A. Bureau of Mines

THE problem of explosions resulting from the contact of oxygen gas with oils was taken up by the United States Bureau of Mines as a result of an oxygen explosion at the Jefferson Physical Laboratory of Harvard University and other similar explosions, in order to supply technical information which would serve for safety precautions in the future. The risk of fires and explosions due to traces of lubricating oil coming into contact with high pressure oxygen is of serious interest to all concerned with the manufacture and use of oxygen.

Up to the present only a few experiments have been carried out, but investigations are proceeding with the object of determining: (1) The critical temperature above which oxidation goes on at a rate of supply heat faster than it is dissipated by conduction, radiation, etc.; (2) the critical pressure of oxygen necessary to cause an explosion when the atmosphere contains oil vapours and is in contact with oiled surfaces; (3) the effect of various catalytic agents such as iron rust, iron oxide, manganese oxide, and copper oxide in the presence of compressed oxygen and oily materials; and (4) the influence of the kind of oil (vegetable or mineral, saturated or unsaturated).

It was recognised by the investigator, Mr. M. D. Hersey, the Physicist to the Bureau of Mines, that there were a large number of variable factors influencing the question. These included temperature, pressure, catalytic action, nature of the surface of the containing vessel, percentage of diluent gases, possibility of electrostatic ignition, the heat capacity of the containing vessel, etc. A very large number of experiments will therefore be necessary in order to determine the effect of these variables.

Negative Results at 60°

The first series of experiments were carried out by Messrs. S. H. Brooks, E. W. Butzler and the author by admitting high pressure oxygen at room temperature into a very small bomb containing a suitable sample of oil. The oxygen was admitted slowly enough to avoid any great temperature rise due to compression. The bomb was surrounded by an electric heating coil, and the temperature on the outside of the bomb just inside the heater was measured by means of a thermocouple. As soon as the valves had been closed the temperature was raised to a standard value of 60° C. and maintained constant for some time. After about an hour the valves were opened, a gas analysis made to detect CO₂, and the interior of the bomb examined. Tests were made on linseed oil and on Mobiloil "A" at pressures up to 2,600 lb. per square inch, and in all cases results were negative. There was not the slightest evidence of even partial combustion. The apparatus was then modified by introducing needle valves and a larger bomb of about 4 c.c. capacity in which the oil sample was dispersed over a coiled roll of paper. For determination of the maximum pressure in case of explosions, a multiple-disk pressure gauge, especially designed for this work, was attached at the end of the explosion cell. Linseed oil, when tried in this second apparatus, again gave a negative result at the standard temperature of 60° C.

Before proceeding to higher temperatures, it was desired to exhaust the possibilities of explosions taking place at temperatures not exceeding 60° C. For this purpose a second series of experiments was carried out by Messrs. J. J. Jakowsky, S. H. Brooks and E. W. Butzler in which a much larger bomb was employed. This was a Parr bomb in which the oil sample was spread over about 150 c.c. of loose cotton waste. Compressed oxygen at a pressure of 2,000 lb. per square inch from a commercial cylinder was suddenly admitted at room temperature; and the internal temperature at some points may have been raised due to compression. The following materials, both separately and in combination, were tested on the cotton waste: Linseed oil, kerosene, iron rust, copper acetylide and water. The results were again negative in all cases. After opening the bomb the materials present showed no evidence of combustion.

A third series of experiments by Mr. Brooks and the author which are now in progress have led to positive results by virtue of raising the initial temperature. For linseed oil on paper at 120° C. and under a pressure of 2,500 lb. per square inch there was a sharp explosion rupturing all of the safety disks

up to and including the disk for 10,000 lb. per square inch. The oil was burned, leaving a black residue on the paper. As the paper was not consumed it appears that this explosion was in the vapour phase, so there is no evidence as yet regarding the formation of any detonating substance by oxygen going into solution in the oil under pressure. These experiments will be continued in order to map out the P, T diagram for different kinds of oil under various conditions. The critical temperature for explosibility of linseed oil under a pressure of 2,500 lb. per square inch of oxygen appears to lie between 60° C. and 120° C.

Theoretical Problems

A number of mathematical problems incident to the design of apparatus and interpretation of experimental data have required investigation beyond the point where they are treated in the standard textbooks. Among the most interesting may be mentioned: (a) Energy required for sudden fracturing of metal; (b) maximum pressure and "flame temperature" as modified by heat transfer; (c) temperature rise due to sudden compression by a piston, as modified by heat loss through the metal before reaching the maximum pressure; (d) heat transfer from and possible temperature rise at the surface of small particles undergoing oxidation, etc.

Examination of Commercial Cylinders

At the start of the work last autumn a detailed inspection of all gas cylinders at the Pittsburgh experiment station (90 of which were compressed oxygen cylinders) was made, as a result of which numerous minor defects were reported, and a schedule of precautionary suggestions for the handling and use of gas cylinders was circulated throughout the Bureau. More recently, in connection with the laboratory experiments, an examination was made of the contents of such cylinders. In the case of CO₂ cylinders a large amount of oil passes out with the gas. From oxygen cylinders there is a very small but definite amount of oily or organic matter deposited in a glass U-tube immersed in a liquid air bath, when the cylinder valve is opened and the oxygen allowed to flow out through the U-tube. In addition, considerable water is collected, which shows an alkaline reaction; also, a relatively large amount of sooty dust is collected on filter paper through which the oxygen gas passes on its way to the U-tube.

Effects of Ozone and Iron

Observations by Mr. Jakowsky show the development of a strong electrostatic charge due to the flow of gases through an orifice when (and only when) dust or moisture passes through the orifice. These experiments were conducted not only to determine the possibility of electrostatic ignition of oil vapour or of splinters of iron, but more particularly in connection with the possibility of ozone formation due to electrification combined with cooling effects. Direct evidence of ozone formation from oxygen was also found in some of these tests. Ozone would react much more actively than oxygen when in contact with oil.

At the present time a series of experiments by Messrs. Jakowsky and Butzler are in progress, which have shown a marked drop in the ignition temperature or iron wire in oxygen, as the pressure is raised. At a pressure of one atmosphere this ignition temperature is about 850° C.; raising the pressure to 2,000 lb. per square inch gradually lowers the ignition temperature to about 500° C. The experiments are to be repeated with oil on the surface of the iron, and with other variations, and will be reported later.

The Export of Helium from America

ADVISING against the exportation of helium from the United States, Dr. Richard B. Moore, former chief chemist of the United States Bureau of Mines, declared before the geology session of the American Institute of Mining and Metallurgical Engineering, in session at Montreal, Canada, that it was of great importance commercially and for national defence that the country's helium monopoly should be retained. Dr. Moore said more than 500,000,000 cubic feet of helium were going to waste annually in the United States in connection with the ordinary use of gas. He declared that in event of war a fleet of 150 or 200 dirigibles could be kept afloat by the construction of proper plants.

The Production of Triatomic Hydrogen

IN a paper read by Mr. G. Stead and Miss B. Trevelyan before Section A (Mathematics and Physics) of the British Association on Friday, September 14, it was described how what is supposed to be triatomic hydrogen was produced by subjecting the gas to intense electronic bombardment in a cylindrical thermionic tube with an open grid and no anode. With a grid potential of 30 volts and over, a blue glow, consisting of primary and secondary hydrogen lines, is observed near the filament. The glow spreads progressively along the tube, the current increasing similarly till it suddenly falls to a small value, and the glow simultaneously runs back. A regular oscillation of the glow and current is maintained, and the pressure in the tube follows the current changes. It appears that a polymerised modification of hydrogen is periodically formed and decomposed. If a tube surrounded by liquid air is attached no oscillation takes place, but nearly all the gas disappears rapidly. It is liberated on removing the liquid air, and is stable, but easily decomposed by electric discharge, showing an increase in volume in the ratio of 1.5 to 1. The decomposed gas shows bright primary and secondary spectra of hydrogen. The optimum pressure in the tube is about 0.05 mm. of mercury.

The Appointment of Public Analysts

It is stated by the Institute of Chemistry in the current number of the *Journal* that the Ministry of Health and the Ministry of Agriculture and Fisheries have declined to confirm, respectively, the proposed appointments of public analyst and official agricultural analyst for the County and City of Gloucester (referred to in *THE CHEMICAL AGE*, July 7, p. 3). Although the Council of the Institute felt that the Ministries would hardly be likely to waive their regulations, they were glad that questions on the matter were put in the House of Commons to the Minister of Health by Mr. C. S. Garland, and that public attention was thereby directed to the importance of exercising care in the selection of candidates for such appointments. It is hoped that both Gloucester authorities will revise the conditions of the proposed appointments in order that they may attract the candidature of chemists who are able to produce evidence in accord with the requirements of the Ministries.

Research and Industry

SIR FRANK HEATH (Secretary of the Department of Industrial and Scientific Research) delivered an address on "Research and Industry" at the Central Technical School, Liverpool, on Thursday, in connection with the exhibition organised by the British Association. His observations may be summed up in the following three points:—(1) There is a growing tendency for the cost and the time of research investigation to increase; (2) there is an increasing need to bring the man who has discovered a suitable new process into living touch with production in order that the new process as applied in the works may be constantly supervised, tested, and corrected by the research worker; and (3) there is a growing necessity for bringing the technical man into a share in the business policy of the industry. Sir Max Muspratt, who presided, said the Department of Industrial and Scientific Research was one of which he and others had the very highest hopes.

Joint Dinner of Chemical Societies

ARRANGEMENTS have been made for an informal dinner and a social gathering of chemists under the joint auspices of the Chemical Society, the Institute of Chemistry and the Society of Chemical Industry, which members of these, and of any other of the Chemical Societies, with their friends (including ladies) may attend. This dinner will be held in the Edward VII Rooms, Hotel Victoria, Northumberland Avenue, London, W.C.2, on the evening of Wednesday, October 31, at 7 for 7.30. The price of tickets for ladies or gentlemen will be 12s. 6d. each, not including wine. The Councils hope that members of the societies mentioned, who intend to be present, will make early application for tickets, which must be limited to 300. These will be issued in the order in which applications accompanied by payment are received. Applications should be sent to the General Secretary, Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2.

Chemical Trade Returns for August

THE official returns of the Board of Trade for the month of August, as referred to briefly last week, show a slight increase in the value of the general trade of the country, which does not, however, apply to the chemical exports. The value of the total imports in August, 1923, was £83,743,197, an increase of £6,127,293 on August, 1922. The import figure for chemicals, dyes, drugs and colours was £1,315,825, an increase of £190,804 over August, 1922, and £519,459 over July, 1923. The total value of the export trade was £60,103,360, being an increase of £71,123 over August, 1922; but chemicals, dyes, drugs and colours combined show a decreased value in exports amounting to £16,753 compared with last year, the total under this heading being £1,645,856. This figure also represents a decrease of £93,705 on July of this year. The most satisfactory figures appearing in the detailed list of quantities given below are those relating to the export of coal tar products generally, such as benzol, toluol, naphthalene, and synthetic dyestuffs, the latter particularly continuing to be exported in quantities very much larger than last year.

Imports for August

INCREASES.	1923.	1922.
Calcium carbide	50,896	24,421
Sodium nitrate	262,313	128,681
Zinc oxide	626	502
Sodium compounds, except nitrate	262,313	128,681
Red lead and orange lead	4,875	2,206
Nickel oxide,	7,127	—
Unspecified coal dyes	3,928	3,252
White lead	11,349	8,496
Turpentine	59,048	34,835
Essential oils, other than turpentine	306,731	256,141
Mercury	93,711	61,290

DECREASES.

	1923.	1922.
Acid, acetic	316	507
Acid, tartaric, including tarantates	1,237	5,707
Bleaching materials	1,290	3,410
Borax	4,150	7,399
Potassium nitrate	6,263	16,147
Unspecified sodium compounds	17,517	19,034
Intermediate coal tar products, including aniline oil and salt, and phenyl glycine	—	2
Alizarine dyes	238	522
Cream of tartar	2,646	3,736
Crude glycerin	—	3,485
Distilled glycerin	286	361
Natural indigo	70	117
Barytes, including blanc fixe	46,008	70,909
Unspecified painters' colours	56,505	59,494

Exports for August

INCREASES.	1923.	1922.
Tartaric acid	706	321
Ammonium sulphate	17,002	14,649
Benzol and toluol	366,562	658
Naphtha	8,840	2,084
Naphthalene	11,168	2,758
Tar oil, creosote, etc.	2,627,301	2,076,635
Unspecified coal tar products	34,614	23,516
Crude glycerin	2,710	1,336
Potassium chromate and bi-chromate ..	3,746	2,103
Sodium carbon, etc.	411,306	311,739
Sodium sulphate, including salt cake ..	101,846	35,495
Paints, ground in oil or water	18,620	16,526
Paints and colours, unspecified	41,448	39,142
Coal tar dyes	12,830	2,868
Unspecified coal tar products	5,265	4,097

DECREASES.

	1923.	1922.
Acid, sulphuric	693	1,377
Acid, carbolic	11,581	19,091
Ammonium chloride	240	444
Copper sulphate	522	860
Distilled glycerin	2,922	8,927
Potassium nitrate	533	1,155
Unspecified potassium compounds	1,068	1,988
Caustic soda	110,042	134,816
Unspecified sodium compounds	56,522	58,714
Zinc oxide	53	332
White lead	7,398	20,669
Barytes, including blanc fixe	427	3,835
Paints and enamels, prepared	12,612	18,109
Sulphate of copper	522	860
Sodium chromate and bi-chromate	4,811	5,331

From Week to Week

THE NUMBER OF MEMBERS attending the British Association meeting this year was 3,296.

MANUFACTURERS of platinum articles are demanding a hall-mark for platinum, with the object of giving greater confidence to purchasers.

THE IMPORTS of drugs, chemicals and fertilisers into Australia for the year ended June 30, were valued at £3,894,435, compared with £3,553,377 for 1921-22.

THE NINTH NATIONAL EXPOSITION of Chemical Industries in the United States opened on Monday at the Grand Central Palace, New York. Saturday is the closing day.

A THIRTY MILES REEF in the Waterberg district, South Africa, has revealed samples of platinum and gold, and sales of ten farms now under option are being negotiated.

MIDTON BLEACHWORKS, Howwood, Renfrewshire, was the scene of a fire on September 12, when a building used for beetling purposes got ablaze, and serious damage was caused.

AUSTRALIA appears to be Britain's keenest competitor in the British Malaya soap market. This is said to be due to the concentrated efforts of the Government and mercantile interests.

CONSIDERABLE interest has been aroused in South Africa by the discovery of an extensive deposit of manganese ore of 80 to 90 per cent. purity, in the Krugersdorp district, the highest part of the Rand.

PROFESSOR NIELS BOHR, the well-known Danish physicist, is now in England in order to attend the meetings of the British Association at Liverpool, after which he will proceed to Canada and the United States.

THE WIGAN CORPORATION has granted permission to the Colliery Explosives Co., Ltd., Earlestown, for the establishment of a factory for the manufacture of explosives at Hawley Hall, Carr's Lane, Wigan. The works are expected to employ about 100 men.

SATISFACTORY PROGRESS is reported in the scheme of the Federation of British Industries in preparing films illustrating representative British industries. Two films will probably be prepared of the chemical industry, and will be included in the first series of twelve.

FIRE broke out in a varnish shed on the premises of A. H. Hamilton and Co., Ltd., oil and paint manufacturers, Possilpark Paint Works, Glasgow, on September 13, and caused damage to the value of £400. Firemen prevented the flames spreading to a petrol store.

THE AGRICULTURAL INFORMATION BUREAU for the French Potash Mines announce that their office in London has been moved to 11-12, Bury Street, St. Mary Axe, E.C.3. The telegraphic address is "Sylvinite, Ald, London," and the telephone number "Avenue" 3205.

IT WAS A DISAPPOINTMENT to many attending the British Association meeting at Liverpool, to learn that the paper by Prince Ginori Conti on "The Utilisation of Volcanic Steam" had been included in the programme in error, having been promised for next year's meeting.

NOTWITHSTANDING that the agreement with the Board of Trade has terminated, the Central Importing Agency wishes it to be known that they continue to operate their extensive connection in aniline dyes and are in a position to supply colour users at lowest current prices.

A CARBOY containing nitric acid was involved in a fire on Monday at the premises of Coates Bros. and Co., manufacturers of bronze powders and printers' sundries, Salisbury Square, London. Owing to the fumes gas masks were worn by the firemen, who quickly stopped the outbreak.

THE "CHEMISTS' EXHIBITION," which for over a quarter of a century has been held in London, was transferred to Glasgow and was open from Monday till Friday at St. Andrew's Halls. This is the first time the exhibition has visited Glasgow, and, except for one occasion, in Leeds, it has never before been held out of London.

IT IS ANNOUNCED that Brotherton and Co., of Leeds, are removing their chemical works, which deal with half the output of tar from the Cumberland Collieries, from Workington. Their lease of the site at Workington Dock, on which the plant was laid down ten years ago, has expired. This decision affects a considerable number of workpeople.

BY A SPECIAL RESOLUTION, and permission from the Board of Trade, the name of Hacars, Ltd., has been changed to THE SALUS CO., LTD. This firm, whose offices are situated at York Road Tube Station, London, are manufacturers of soaps and disinfectants, one of their specialities being "Salus" Lysol.

AT THE New Brancepeth Colliery, near Durham, two men who were sent to clean out a tank at the benzol plant were found lying at the bottom of the tank, having evidently been overcome by the poisonous gases they had disturbed. Artificial respiration was resorted to for two hours, but without avail.

LORD LEVERHULME on Wednesday informed a mass meeting of co-partners of Lever Brothers at Port Sunlight that freehold building plots would be given to their workpeople for single or semi-detached houses built to the owner's designs approved by the company's architect. Co-partners would have preference, and other plots would go to any other persons.

AT THE Sanitary Inspectors' Conference at Rhyl last week, Mr. Kershaw, of Hampstead, deprecated the indiscriminate use of preservatives and colouring agents in food for human consumption. Medical experts, he said, were of opinion that the effect of drugs in food was an undetermined factor, and that minute doses taken over a prolonged period must ultimately be fatal.

THERE WAS NO SESSION of the British Association at Liverpool on Saturday, the day being devoted to excursions. On Sunday special sermons were preached in several of the Liverpool churches. The meeting of the Association next year will be held in Toronto from September 3 to September 10, with excursions to the Far West beforehand. In 1925 the Association will meet at Southampton.

MR. CECIL H. CRIBB will represent the Institute of Chemistry at a conference of the National Clean Milk Society, which is to be held in the City of London in November. The subjects for discussion will include the methods and machinery for the production of pasteurised milk, the physical, chemical, biochemical and bacteriological changes caused by pasteurisation, and the commercial and financial aspects of the subject.

REFERRING TO the broadcasting of his presidential address, Sir Ernest Rutherford, at the closing meeting of the British Association on Wednesday, suggested that he had been murdered "to make a Roman holiday," but added that he had received many personal letters, not only from friends, but from young people he did not know in all parts of Britain, saying that they heard the address quite clearly and enjoyed it.

A PROPOSAL has been made in America by Mr. F. H. Brownell, first vice-president of the American Smelting and Refining Company, for the formation of a silver export association. Mr. Brownell believes that such an association, acting as a reservoir to equalise the variation between supply of and demand for silver with a view to stabilisation and enhancement of its price, would be practicable with American and British support, Governmental and financial.

AT A CONFERENCE held on Saturday at the offices of Biggart, Lumsden and Co., Glasgow, it was agreed that the reduction recently imposed by the Scottish Committee of Chemical Manufacturers should be withdrawn in the case of Ross's Chemical Works, Falkirk; R. Smith's Executors (Ltd.), Glasgow and Paisley; and J. Miller and Co.'s Chemical Works, Aberdeen. Messrs. J. M'Kenzie and J. Addison, representing the National Union of General Workers, gave Mr. Davidson, the employers' representative, an assurance that in future one week's notice will be given on each side before any stoppage of work can take place.

AT LIVERPOOL UNIVERSITY on Monday, honorary degrees of Doctor of Science were conferred upon Sir Ernest Rutherford (president of the British Association), Professor Niels Bohr, of Copenhagen, Professor Ernest Howard Griffiths (treasurer of the British Association), Professor Gilbert Newton Lewis (Professor of Chemistry at the University of California), Professor John Cunningham McLennan (Professor of Physics in the University of Toronto), Professor Ernest Johannes Schmidt (director of the Carlsberg Laboratory in Copenhagen), and Professor Grafton Elliott Smith (director of the new Rockefeller Institute for Medical Research in the University of London). The assembly at which the degrees were conferred embraced the heads and leading teachers of the Liverpool University and other distinguished people.

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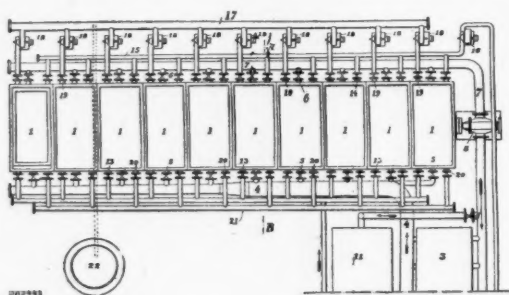
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Abstracts of Complete Specifications

- 202,333. BITUMINOUS OR CELLULOSE CONTAINING MATERIAL, PROCESS FOR THE DRY DISTILLATION OF. I. Moscicki, 3, Ulica Leona Sapiehy, Lwow, Poland. Application date, February 16, 1922.

The bituminous or cellulose-containing substance is distilled by mean of a current of distillation gases circulating continuously through a superheater and cooler. A number of distillation chambers 1 of sheet iron are shown in plan, each being heat-insulated and covered with a hydraulically sealed



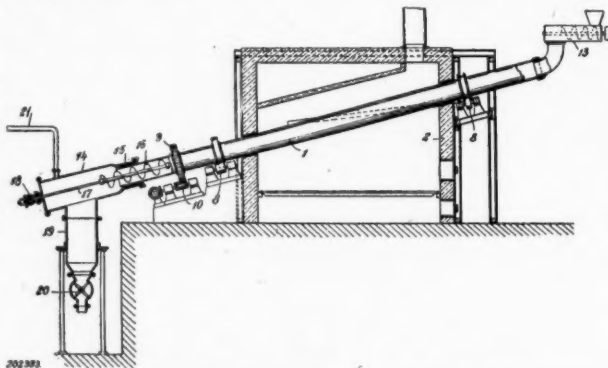
cover. Each chamber contains a metal receptacle open at the top and perforated at the bottom. This container is lifted out to be filled, and then replaced. Hot gases for distillation pass from a superheater 3 through a pipe 4 to the chambers 1, each inlet being closed by a valve 5. These gases with the distilled vapour pass through valve 6 to a pipe 7, a fan 8, and a condenser 11, and thence back to the superheater. The non-condensed gas may be passed through valves 13 into those chambers 1 which are freshly charged, to displace the air. The mixture of air and gas passes through valves 14, pipe 15, and fan 16, to the combustion chamber of the superheater. The residue in the distillation chambers is cooled by injecting gas from pipes 17 through fans 18 and valves 19, and the gas thus preheated passes through valves 20 into a collecting pipe 21, from which it is led into these distillation chambers from which air has been displaced. The cooled gas passes back through the valves 19 to the pipes 17. In the plant shown, five of the chambers are undergoing distillation in different phases, due to their starting at equal intervals of time. Two other chambers are being cooled down, and two further chambers are undergoing drying and preheating, while the remaining chamber is being recharged. By this plant a complete continuity of the process may be obtained, and owing to the fact that the phases in all the distillation chambers follow one another in succession, the temperature of the gas and vapour mixture which enters the superheater remains practically constant at about 250° C. The plant may be used for the dry distillation of coal, and the products are semi-coke, tar in single fractions, and coal gas of high calorific value.

- 202,382. RETORTS AND THE LIKE. H. G. C. Fairweather, London. From the Air Reduction Co., Inc., 342, Madison Avenue, New York. Application date, May 15, 1922.

In operations requiring the use of retorts, furnaces, etc., such as the manufacture of coal gas, oil gas, or the fixation of atmospheric nitrogen, difficulties are experienced in the use of iron retorts and furnaces due to the rapid corrosion and oxidation at high temperatures. It is now found possible to provide the iron with a coating consisting of a base metal alloy which is practically integral with the iron, and protects it from the oxidising action of the hot gas. The particles of the coating metal may be in a molten state and sprayed against the surface to be coated, or the coating metal may be converted into fine particles and projected against the surface to be coated at a very high velocity, so that they become welded to it. The coating thus formed is integral with the iron sheet to which it is applied. The coating may consist of an alloy containing 85 per cent. of nickel and 10-15 per cent. of chromium, with small amounts of iron, manganese, and carbon. In another example, the alloy may consist of nickel 50-60 per cent., chromium 10-20 per cent., and iron 10-30 per cent.

- 202,383. ALKALI CYANIDES, PROCESS OF MANUFACTURE OF. H. G. C. Fairweather, London. From the Air Reduction Co., Inc., 342, Madison Avenue, New York. Application date, May 15, 1922.

The process is for the production of alkali cyanides by heating in a furnace a mixture of alkali metal carbonate and/or alkali metal hydroxide, coke, charcoal or the like, and a catalytic material such as iron, at a high temperature in the presence of nitrogen. In this process difficulties are experienced due to the effect of the high temperature (850°-1,000° C.) on the apparatus. Further, the furnace charge is in a semi-fluid condition, and contracts to about two-thirds of its original volume, thus producing channels in its mass and preventing intimate contact with the nitrogen. In the present invention, the reaction zone is kept substantially full, and the charge is kept in motion. The retort consists of a cylindrical metal tube 1, about 15 inches in diameter, and preferably of an alloy of nickel, chromium, and iron, with or without small quantities of manganese, silicon, etc. The tube 1 passes through the furnace 2 in an inclined direction, and is supported on rollers 8 at each end. The charge is fed into the upper end by means of a conveyor 13, and is maintained in movement within the retort by means of the rotation of the latter through gearing 9, 10. The lower end of the retort projects into a stationary casing 14, provided with gastight packing 15. A discharge conveyor 16 carried by a shaft 17 projects into the lower end of the retort, and the residue is received in the hopper 19, provided with a discharge valve 20, which prevents the exit of gases or inlet of air. The gases containing nitrogen are admitted through a pipe 21. The upper end of the retort outside the furnace constitutes a pre-heating zone, and the lower projecting portion constitutes a cooling zone for the residue, and a preheating zone for the incoming nitrogen. The retort is maintained substantially filled with the charge, which although plastic in the hottest zone, is maintained in intimate contact with the gases by means of the rotation of the retort. This rotation also causes solidifying material at the lower end to become broken up, and so facilitates its subsequent treatment by means of steam to obtain ammonia, or the extraction of cyanide from it.



- 202,401. WATER SOLUBLE OIL, PROCESS OF PRODUCING. H. W. Hutton, Milnbank Refineries, Townmill Road, Dennistoun, Glasgow. Application date, May 18, 1922.

This oil is produced by mixing sulphonated unsaponified castor oil with unsaponified fatty oil or fixed oil, other than castor oil, which has been separately sulphonated, and with unsulphonated mineral oil; the mixture is then treated with caustic alkali to saponify the sulphonated oils. In an example, sperm oil, lard oil, or cottonseed oil, is sulphonated with one-third of its weight of sulphuric acid, and placed in a tank with an equal volume of salt water. This mixture is agitated with a larger amount of mineral oil or tar oil, so that the sulphuric acid is washed out and removed. Castor oil sulphonated with one-third of its weight of sulphuric acid (50 per cent. sulphonated Turkey red oil) is then added, and then mixture agitated and neutralised with caustic soda. This oil completely emulsifies with water. In another example, a mixture of sulphonated fatty oil 2 parts, salt water 2 parts,

50 per cent. sulphonated Turkey red oil 2 parts, and mineral oil 6 parts, is heated to about 150° F., and the acidulated water allowed to settle and removed. The mixture is again heated to 150° F. and caustic soda solution added until the mixture completely emulsifies with water, and is slightly alkaline.

202,422. REFINING HYDROCARBONS, PROCESS FOR. Plauson's Parent Co., Ltd., 17, Waterloo Place, Pall Mall, London, S.W.1. From H. Plauson, 26, Jarrestrasse, Hamburg, Germany. Application date, May 22, 1922.

The process is for refining mineral oils, petroleum, benzene, paraffin, ceresin, etc., by the use of sodium or potassium bi-sulphate or pyrosulphate, instead of concentrated sulphuric acid. The bi-sulphate commences to attack the impurities at about 110° C. and the reaction is complete at about 250° C. The saturated hydrocarbons are not attacked. The purification may be effected by evaporating the hydrocarbon in a retort, and passing the vapour through a layer of bisulphate arranged in the neck of the retort, or over a layer of bisulphate carried by perforated shelves of refractory or ceramic material. Better results are obtained if the bisulphate is contained in a rotating drum provided with baffle plates, and the vapour is passed through the drum. If about 0.1-0.5 per cent. of nitric or nitrous acid or their salts, or acid phosphates, are added, the reaction is accelerated. In an example, a mixture of dark red fluorescent mineral oil 100 parts and potassium bisulphate 50 parts is heated for one to two hours at 150°-200° C. Sulphurous acid is evolved and may be collected and oxidised to sulphuric acid. The mixture is then distilled, yielding a clear yellow distillate, and an acid cake which may be boiled with water to yield potassium sulphate. This may be reconverted to the bisulphate by means of the recovered sulphuric acid. The oil possesses only slight fluorescence and odour, and may be treated again to obtain a water-clear oil. In another example, a mixture of crude benzene 100 parts and sodium bisulphate 10-20 parts is heated in an autoclave to 110°-150° C., at a pressure of 10 atmospheres, and then distilled, yielding water-clear benzene. Crude petroleum may be treated in a similar manner at 150°-200° C., under a reflux condenser or under pressure, and then distilled to obtain the purified product. In another example, paraffin is treated in this manner, and the mixture allowed to stand after heating. An upper layer separates consisting of hard paraffin, and a lower layer consisting of the impurities and the sulphate. These two layers are readily separated. Ceresin, ozokerite, and montan wax may be treated in a similar manner to refine them, but a further distillation in vacuo and with superheated steam may be necessary.

202,532. PURE ANTIMONY, PROCESS FOR DIRECTLY OBTAINING. A. Germot, 56, Avenue de la Marne, Asnières (Seine), France. Application date, September 8, 1922.

Pure antimony is obtained by dissociation of the trisulphide at a high temperature, without the intermediate production of the oxide. The trisulphide is dissociated by heating in a closed vessel, and the molten antimony drawn off without any trace of sulphur. The antimony sulphide is fed into an electrically heated furnace, and passes into a lower compartment, in which the molten antimony accumulates and is tapped off. The sulphide and sulphur vapour which are evolved pass upwards through a heated inclined flue, where the sulphide is dissociated, and the antimony flows back to the furnace chamber. The sulphur vapour passes on to a subliming chamber where it is collected.

NOTE.—Abstracts of the following specifications which are now accepted appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention:—177,493 and 191,085 (S. M. Cadwell) relating to processes for vulcanising rubber, see Vol. VI., p. 705, and VIII., 243; 181,376 (T. Goldschmidt Akt.-Ges.), relating to the enrichment of gaseous mixtures with respect to certain constituents, see Vol. VII., p. 248; 182,134 (Soc. d'Etudes Chimiques pour l'Industrie), relating to the employment of the residues resulting from the decomposition of calcium cyanamide, see Vol. VII., p. 322; 189,782 (Soc. pour l'Industrie Chimique à Bale), relating to the manufacture of indigoid dyestuffs, see Vol. VIII., p. 152; 190,157 (T. Goldschmidt Akt.-Ges., L. Schertel and W. Luty), relating to the production of finely divided solid substances by volatilisation, see Vol. VIII., p. 182; 195,077 (Waterloo Chemical Works, Ltd.), relating to the manufacture of ferric hydroxide, see Vol. VIII., p. 576.

International Specifications not yet Accepted

200,788-9. VULCANISING INDIARUBBER. Naugatuck Chemical Co., Elm Street, Naugatuck, Conn., U.S.A. (Assignees of S. M. Cadwell, 200, Ames Avenue, Leonia, N. J., U.S.A.). International Convention date, July 13, 1922.

200,788.—A composition for vulcanising indiarubber with or without heat consists of a mixture of sulphur; zinc oxide or other compound of zinc, mercury, lead, cadmium, copper, arsenic or manganese; carbon disulphide; and a primary or secondary amine. The carbon disulphide may be replaced by carbon oxysulphide, and carbon tetrachloride may be added to reduce inflammability. If the latter is absent, the amine must be an aliphatic amine. Suitable amines are methylamine, dimethylamine, diethylamine, benzylamine, dibenzylamine, piperidine, aniline, paratoluidine, triethyl-trimethylene-triamine, and tribenzyl-trimethylene-triamine. The carbon bisulphide may be omitted from the composition, and may be applied subsequently to the article, in liquid or vapour form. Examples are given of composition which complete the vulcanisation in 2-3 hours at 180°-200° F., and in 48 hours at ordinary temperature.

200,789. In a vulcanising process as described in 200,788, one or more of the ingredients is introduced into the rubber by diffusion, either in liquid or gaseous form, or in solution in a solvent such as benzol, carbon tetrachloride, gasoline, or chloroform. Suitable amines and derivatives of carbon disulphide and oxysulphide are mentioned in Specification 177,493 (see THE CHEMICAL AGE, Vol. VI, p. 705). Compounds containing more than one of the vulcanisers may be used, such as oxynormal-butyl-thiocarbonic acid disulphide, tetramethyl-thiurammono-sulphide, and zinc butyl xanthogenate. Examples are given in which rubber is dipped for one minute in chloroform containing sulphur 1%, tetramethyl-thiurammono-sulphide 2% and zinc stearate 1%. Vulcanisation is then completed in 30 minutes at 275° F.; and in another example, rubber containing 10% of zinc oxide and 3% of sulphur is painted with dibenzylamine and carbon disulphide. Vulcanisation is complete in one week at ordinary temperature.

200,810. SYNTHETIC DRUGS. Chemische Fabrik Flora, Dübendorf, Zürich, Switzerland. International Convention date, July 14, 1922.

2-methyl-4-diethylamino-pentanol-5 or the corresponding dimethyl compound is condensed with *p*-nitrobenzoyl chloride, and the nitro-ester is then reduced in aqueous solution with hydrogen and platinum black, or tin and hydrochloric acid, to produce *p*-aminobenzoyl-2-methyl-4-diethylamino-pentanol-5 or the corresponding dimethyl compound.

200,815, 200,816, 200,827 and 200,834. CELLULOSE ETHERS. L. Lilienfeld, 1, Zeltgasse, Vienna. International Convention date, July 13, 1922.

200,815. Cellulose ethers are made by using an amount of caustic alkali greater than the amount of cellulose, and an amount of water between $\frac{1}{2}(a^2 - a + 2)$ and $\frac{1}{2}(1.5a^2 - 1.5a + 3)$ where *a* is the ratio of caustic alkali to cellulose. Catalysts such as copper, copper salts, ferrous sulphate, etc., may be used, as well as diluents such as benzol, and the etherification may be effected in several stages. If *a* is between 1.5 and 2.5, the ether obtained is water-resistant. Conversion products, derivatives, or ethers of a lower stage may be used instead of cellulose.

200,816. Cellulose or a conversion product or derivative is treated with the correct amount of caustic alkali but an excess of water, or with an excess of alkali solution followed by pressing to remove the surplus. The alkali cellulose thus obtained is dried in a vacuum apparatus provided with cooling means to reduce the temperature below 10° C. The material is dried in thin layers, or it may be stirred or kneaded, or it may be dried in a blast of cold air or inert gas such as hydrogen or nitrogen, using a desiccating agent. The alkali cellulose of low water content thus obtained are particularly suitable for the manufacture of cellulose ethers.

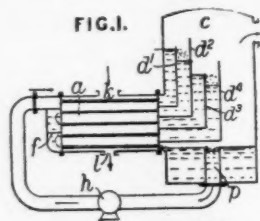
200,827. Alkali cellulose may be made as above, or by treating cellulose with alkali solution, removing most of the water by pressing and drying, and then mixing with solid caustic alkali. The alkali cellulose is then etherified. If agents of low boiling point are used, such as ethyl chloride or bromide, an autoclave must be used, but with dialkyl sulphates, benzyl chloride, ethyl iodide, etc., an open vessel

with a reflux condenser may be used. The ether is separated by mixing with water, filtering, washing and drying, or by washing, treating with dilute acid, washing and drying. Examples are given of the production of an ether from cellulose and ethyl chloride, which is soluble in benzol, alcohol, benzol-alcohol, chloroform, chloroform-methyl-alcohol, methyl acetate, and glacial acetic acid.

200,834. To obtain cellulose ethers of a high degree of etherification, cellulose having little or no water content, and a low alkali content, is treated with an etherifying agent, and the resulting intermediate product treated with more alkali and etherifying agents. In the first stage the cellulose containing less than 0.5 of water to 1 part of cellulose is treated with alkylating or aralkylating agents in the presence of less than 1.5 mols. of caustic alkali to 1 mol. of cellulose. If the water content is very small the product is partly soluble in cold water and in glacial acetic acid and hydrochloric acid. If the water content is larger, the product is soluble in aqueous alkalies. This product may then be further etherified, with or without previous isolation. If large quantities of water, small quantities of alkali, and low temperature are employed, the resulting ethers are soluble in organic solvents, and are soluble or swell in cold water, so that they may be readily dyed. If small quantities of water, large quantities of alkali, and a higher temperature are employed, the ethers are hard, and are suitable for making lacquers or varnishes. The etherification is preferably effected with alkyl or aralkyl esters of inorganic acids, such as ethyl or methyl chloride, ethyl bromide, dialkyl sulphates, benzyl chloride and ethyl iodide. The product of the first etherification may be separated by washing with hot water and drying. The intermediates may be converted into films or threads by the use of acid precipitants. In examples, the ethers obtained by the use of ethyl chloride and diethyl sulphate are soluble in alcohol, benzol, alcohol-benzol, glacial acetic acid, chloroform, chloroform-alcohol, methyl-acetate-methyl alcohol.

201,123. EVAPORATING LIQUIDS. Soc. des Condenseurs Delas, 103, Rue St. Lazare, Paris. International Convention date, July 21, 1922.

A pump *h* forces the liquid through a tubular heater *a*, heated by steam, hot water, or hot gases passing through from



201,123

h to *l*. The liquid passes in series through the tubes, passing from one row to the next over successively lower baffles *d*¹, *d*², in the evaporator *c*. Partitions *d*³, *d*⁴, *f* are provided to separate the rows of tubes, and the liquid finally returns through a well *p* to the pump *h*.

200,838. ELECTROLYSIS. Electro Chemical Co., 113, Court Street, Dayton, Ohio, U.S.A. (assignees of J. Gerstle, Miami Hotel, Dayton, Ohio, U.S.A.). International Convention date, July 15, 1922.

In an electrode structure suitable for a hypochlorite cell, the cathode consists of silver wire which is stretched in the form of a grid over the face of a non-conducting plate, all the bends being soldered to connecting bars at one end of the plate. The anodes may be of graphite, and may be fixed on either side of the cathode by bolts and insulating nuts.

200,839. ACTIVE CHARCOAL. Farbwerke vorm. Meister, Lucius and Brüning, Höchst-on-Main, Germany. International Convention date, July 15, 1922.

Carbonaceous material such as wood, turf, straw, brown coal, or a mixture of these, is heated internally in a revolving furnace by means of combustion gases in the presence of an acid of phosphorus. Air or oxygen may be added to the combustion gases, and oxygen should be present in the exhaust gases.

LATEST NOTIFICATIONS.

- 203,683. Process for the manufacture from cyanamide of manures containing soluble organic nitrogen. Soc. d'Etudes Chimiques pour l'Industrie. September 8, 1922.
 203,693. Alloys of molybdenum with improved chemical, mechanical, and electrical qualities. Norske Molybden-produkter Aktieselskabet. March 26, 1921.
 203,708. Process for the production of aluminium-fluoride-alkali-fluoride double compounds technically free from iron. Chemische Fabrik Griesheim Elektron. September 8, 1922.
 203,709. Manufacture of chromates and bichromates. Jouve, A. J. B., Helbronner, A., and Soc. Hydro-Electrique et Metallurgique du Palais. November 23, 1921.

Specifications Accepted, with Date of Application

- 180,315. Distillation of combustibles. Soc. de Fours à Coke et d'Entreprises Industrielles. May 18, 1921.
 180,657. Hydrocarbon oils, Method of and apparatus for dehydrating, distilling, and cracking. E. O. Linton. May 26, 1921.
 188,656. Chloridising volatilisation of metals, Process for. S. J. Vermaes and L. L. J. van Lijnden. November 12, 1921.
 189,787. Urea, Isolation of. Soc. des Produits Azotes. November 29, 1921.
 192,415. Barium hydroxide, Processes for the manufacture of. J. Michael and Co. January 27, 1922.
 203,013. Drying, grinding and neutralising sulphate of ammonia in one operation, Apparatus for. A. H. Thwaite and Pease and Partners, Ltd. April 21, 1922.
 203,032. Black azo dyestuffs, Manufacture of. A. G. Bloxam. (Chemische Fabrik Griesheim Elektron). May 29, 1922.
 203,051. 2:3-diamino-anthraquinone, Manufacture of. O. Y. Imray. (Soc. of Chemical Industry in Basle). May 31, 1922.
 203,059. Reduction of organic compounds, particularly of nitro- and azo-derivatives. D. G. Murdoch and W. L. Galbraith. June 2, 1922.
 203,060. Organic compounds, Treatment of—with nitrous acid. N. E. Siderfin, S. B. Tallantyre, W. V. Shannon, and W. L. Galbraith. June 2, 1922.
 203,062. Refractory lining of furnaces, converters, and the like, Method of forming. W. P. Thompson. (E. Bong.) June 6, 1922.
 203,068. Device for the separation of solid, liquid and semi-gaseous matter from gases and vapours. J. A. Wilisch. June 7, 1922.
 203,077. 3:3'-diamino-4:4'-dihydroxy-arsenobenzene and other arseno bases, Manufacture of. M. Pomaret and May and Baker, Ltd. June 10, 1922.
 203,098. Hydrocarbons, Purification of. Whitehall Petroleum Corporation, Ltd. (A. Greenspan.) June 22, 1922.
 203,109. Preserving foods, Process and apparatus for. Plauson's (Parent Co.), Ltd. (H. Plauson.) June 28, 1922.
 203,124. Phenol Aldehyde condensation products, Production of. G. Petroff. July 7, 1922.
 203,144. Carbonaceous material, Apparatus for distilling. W. P. Perry. August 1, 1922.
 203,158. Base-exchanging compounds, Manufacture and production of. T. P. Hilditch, H. J. Wheaton, and J. Crossfield and Sons, Ltd. August 14, 1922.
 203,183. Hydro-magnesite, Treatment of. W. S. Rawson. August 29, 1922.
 203,218. Metallic catalysts, Method of activating and reactivating—applicable to the production of such catalysts in powder form, and to the obtention of a continuous hydrogenating process. Technical Research Works, Ltd., and E. J. Lush. October 20, 1922.
 203,271. Barium hydroxide, Processes for the manufacture of. J. Michael and Co. January 27, 1922.
 203,271. Mineral sodium carbonates, Process for working-up. R. H. D. Blattner. (L. Grouckhine.) February 7, 1923.

Applications for Patents

- Aktiebolaget Separator. Centrifugal separators. 22703. September 10. (Sweden, September 12, 1922.)
 — Centrifugal separators. 22708. September 10. (Sweden, September 13, 1922.)
 Beckett, E. G. Dyes. 23093. September 14.
 Eller, K. B. E. Treatment of peat, and production of gas and by-products therefrom. 23091. September 14.
 Ellis, G. B., and Lecar Carbon Co. Carbonising compound. 23019. September 13.
 Kahl, L., and Rütgerswerke Akt.-Ges. Distillation of tars. 23096. September 14. (Germany, December 20, 1922.)
 Potter Drug and Chemical Corporation and Rushen, P. C. Machines for cutting soap, etc. 22807. September 11.
 Ricard, Allenet, et Cie. Vulcanisation of india-rubber. 22910. September 12. (France, September 15, 1922.)
 — Dehydration of alcohol of carburants. 23084. September 14. (Belgium, September 30, 1922.)

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

London, September 20, 1923.

THE slight improvement noted last week in the demand continues, and prices on the whole are very firm.

Export demand is only moderate.

General Chemicals

ACETONE continues scarce and price very firm.
ACID ACETIC appears to be in slightly better supply, but the price is well maintained.
ACID CITRIC is in poor request and the market is none too strong.
ACID OXALIC has been in better request and the price is well maintained.
BARIUM CHLORIDE continues in good demand and price firm.
CREAM OF TARTAR is slightly easier with only a quiet demand.
FORMALDEHYDE appears to have found its level and business has been better.
LEAD ACETATE is firm and in better demand.
LEAD NITRATE.—Unchanged.
LIME ACETATE continues in very short supply and price firm.
LITHOPONE is in good request and price inclined to be firm.
POTASSIUM CARBONATE.—Only in poor request and price nominally without change.
POTASSIUM PRUSSIAN.—Business is only moderate, price unchanged.
POTASSIUM PERMANGANATE is in fair request without change in value.
SODIUM ACETATE is slightly easier but the demand is well maintained.
SODIUM HYPOSULPHITE moves fairly well into consumption at English makers' figures.
SODIUM PRUSSIAN remains very dull and only in poor request.
SODIUM SULPHIDE.—Makers' prices are unchanged, and the demand leaves a good deal to be desired.
ZINC SALTS.—Unchanged.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID continues in seasonable demand, price unchanged.
ACETANILID.—Continental makers' prices are above London parity. At present limited stocks are offering here at previous rates.
ACID LACTIC is advancing.
CALCIUM LACTATE is in better demand.
COCAINE is firm.
METHYL SALICYLATE is higher.
MERCURIALS.—Corrosive Sublimate, Calomel, and other salts are easier in sympathy with Mercury.
PHENAZONE.—Tendency upward, in demand for export.
QUININE is unchanged. Hoshi works are reported to be undamaged by the earthquake in Japan.
SODA SALICYLATE is unchanged.

Coal Tar Intermediates

The position remains practically unchanged and some fair inquiries have been received from Continental buyers.
ALPHA NAPHTHOL remains unchanged and fair export inquiries have been received.
ALPHA NAPHTHYLAMINE is steady with small business passing.
ANILINE OIL.—Some interest has been shown for export.
BENZALDEHYDE is featureless.
BENZIDINE BASE is without change.
BETA NAPHTHOL remains steady at last quoted figures.
DIMETHYLANILINE has been inquired for, both on home and export account.
NAPHTHONATE OF SODA continues very firm with good demand.
NAPHTHONIC ACID is in steady demand at last prices.
NITRO BENZOL remains unchanged.
PARAPHENYLENEDIAMINE.—Some inquiry has been received.
RESORCINE.—Business has been placed for home account.

Coal Tar Products

There is no great change in the condition of the market for coal tar products since last week.

90% BENZOL shows signs of falling price and is quoted at 1s. 3½d. per gallon on rails at works.

PURE BENZOL is in poor demand and is worth 1s. 7d. to 1s. 8d. per gallon on rails.

CREOSOTE OIL remains firm at 8½d. to 8¼d. per gallon on rails in the North, and in the South the price is from 9½d. to 9¼d.

CRESYLIC ACID is slightly better and is quoted at 1s. 10d. to 1s. 11d. for the pale 97/99% quality, and 1s. 7d. to 1s. 8d. for the dark 95/97%.

SOLVENT NAPHTHA has a poor market and is worth about 1s. 2d. per gallon on rails.

HEAVY NAPHTHA is also in poor demand and worth about 1s. 3d. on rails.

NAPHTHALENES remain plentiful; the crude qualities are worth £6 to £6 10s. per ton, while the 74/76 and 76/78 qualities are worth about £7 10s. to £8 per ton.

PITCH.—The demand from abroad is fairly satisfactory, but prices show a somewhat easier tendency. To-day's values are 130s., f.o.b. London; 125s. to 130s., f.o.b. east and west coast.

Sulphate of Ammonia

SULPHATE OF AMMONIA.—There is an improved demand for export, and prices are still maintained.

[Current Market Prices on following pages.]

The Effect of Alkaline Solutions on Corrosion

THE work reported in a recent paper by Messrs. F. N. Speller and C. R. Texter before the American Chemical Society showed the rate of corrosion in steel pipe is decreased in a closed system by increasing concentration of the alkaline, but no point was found where corrosion increased to a maximum in alkaline solutions; nor did corrosion cease within the limits of alkalinity used in these investigations (4.7 grams per litre) under oxygen contraction and temperature conditions which were used to approximate hot water and boiler conditions. Apparently the first effect after starting the flow of an alkaline water through clean pipe is the rapid formation of a protective coating or film which prevents an intimate contact with the metal of the water. The authors imagine that this film formation is of greater importance in corrosion than the decrease in hydrogen ion concentration of the water. This film is so adherent as to require cleaning with acid before the original rate of corrosion is restored. As indicated by a check test with neutral water in this case the film was evidently caused by the alkalinity and not by the scale-forming constituents in the water as shown by runs with alkaline and distilled water. Other investigations (not yet published) carried on by the authors indicate that the protective effect of this film and its permanence may be greatly increased by the addition of alkaline reagents to the water.

The Titration of Boric Acid

IN a recent paper by Messrs. M. G. Mellon and V. N. Morris, of the American Chemical Society, it is stated that mannitol, glycerol, etc., increase the degree of ionisation of boric acid in aqueous solution to such an extent that one may then determine it by titration with a base in the presence of a suitable indicator. Many polyhydroxy-organic compounds, such as polyalcohols, sugars, polyphenols, and hydroxyacids, change the acidic properties of the acid; but the pH curves for its titration in the presence of these compounds show that when used in the proportion of four moles of organic compound to one of boric acid, only a few are of value for making volumetric determinations. Of the compounds used the polyalcohols are the most effective, while the hydroxy-acids are of no value. From the standpoint of effectiveness along with low cost, invert sugar seems to be the most desirable.

Current Market Prices

General Chemicals

Current Market Prices									
General Chemicals									
	Per	£	s.	d.		£	s.	d.	
Acetic anhydride, 90-95%.....	lb.	0	1	4	to	0	1	5	
Acetone oil.....	ton	80	0	0	to	85	0	0	
Acetone, pure.....	ton	127	10	0	to	130	0	0	
Acid, Acetic, glacial, 99-100%.....	ton	73	0	0	to	74	0	0	
Acetic, 80% pure.....	ton	50	0	0	to	51	0	0	
Acetic, 40% pure.....	ton	25	0	0	to	26	0	0	
Arsenic, liquid, 2000 s.g.....	ton	85	0	0	to	88	0	0	
Boric, commercial.....	ton	48	0	0	to	52	0	0	
Carbolic, cryst. 39-40%.....	lb.	0	1	1½	to	0	1	2½	
Citric.....	lb.	0	1	6½	to	0	1	7	
Formic, 80%.....	ton	50	0	0	to	51	0	0	
Hydrofluoric.....	lb.	0	0	7½	to	0	0	8½	
Lactic, 50 vol.....	ton	39	0	0	to	40	0	0	
Lactic, 60 vol.....	ton	44	0	0	to	46	0	0	
Nitric, 80 Tw.....	ton	26	0	0	to	27	0	0	
Oxalic.....	lb.	0	0	6½	to	0	0	6½	
Phosphoric, 1.5.....	ton	35	0	0	to	38	0	0	
Pyrogallol, cryst.....	lb.	0	5	9	to	0	6	0	
Salicylic, technical.....	lb.	0	1	9	to	0	2	0	
Sulphuric, 92-93%.....	ton	6	0	0	to	7	0	0	
Tannic, commercial.....	lb.	0	2	3	to	0	2	9	
Tartaric.....	lb.	0	1	3½	to	0	1	4	
Alum. lump.....	ton	12	10	0	to	13	0	0	
Chrome.....	ton	28	0	0	to	29	0	0	
Alumino ferric.....	ton	7	0	0	to	7	5	0	
Aluminium, sulphate, 14-15%.....	ton	8	10	0	to	9	0	0	
Sulphate, 17-18%.....	ton	10	10	0	to	11	0	0	
Ammonia, anhydrous.....	lb.	0	1	6	to	0	1	8	
880.....	ton	32	0	0	to	34	0	0	
920.....	ton	22	0	0	to	24	0	0	
Carbonate.....	ton	32	15	0	to	—	—	—	
Chloride.....	ton	50	0	0	to	55	0	0	
Muriate (galvanisers).....	ton	35	0	0	to	37	10	0	
Nitrate (pure).....	ton	35	0	0	to	40	0	0	
Phosphate.....	ton	65	0	0	to	68	0	0	
Sulphocyanide, commercial 90% lb.	0	1	1	0	to	0	1	3	
Amyl acetate, technical.....	ton	280	0	0	to	300	0	0	
Arsenic, white powdered.....	ton	70	0	0	to	72	0	0	
Barium, carbonate, Witherite.....	ton	5	0	0	to	6	0	0	
Carbonate, Precip.....	ton	15	0	0	to	16	0	0	
Chlorate.....	ton	65	0	0	to	70	0	0	
Chloride.....	ton	15	10	0	to	16	0	0	
Nitrate.....	ton	33	0	0	to	35	0	0	
Sulphate, blanc fixe, dry.....	ton	20	10	0	to	21	0	0	
Sulphate, blanc fixe, pulp.....	ton	10	5	0	to	10	10	0	
Sulphocyanide, 95%.....	lb.	0	0	11	to	0	1	0	
Bleaching powder, 35-37%.....	ton	10	7	6	to	10	17	6	
Borax crystals, commercial.....	ton	25	0	0	to	—	—	—	
Calcium acetate, Brown.....	ton	13	0	0	to	14	0	0	
Grey.....	ton	22	0	0	to	23	0	0	
Carbide.....	ton	16	0	0	to	17	0	0	
Chloride.....	ton	5	15	0	to	6	0	0	
Carbon bisulphide.....	ton	35	0	0	to	40	0	0	
Casein technical.....	ton	100	0	0	to	105	0	0	
Cerium oxalate.....	lb.	0	3	0	to	0	3	6	
Chromium acetate.....	lb.	0	1	1	to	0	1	3	
Cobalt acetate.....	lb.	0	6	0	to	0	6	6	
Oxide, black.....	lb.	0	9	6	to	0	10	0	
Copper chloride.....	lb.	0	1	1	to	0	1	2	
Sulphate.....	ton	26	0	0	to	27	0	0	
Cream Tartar, 98-100%.....	ton	92	0	0	to	93	10	0	
Epsom salts (see Magnesium sulphate)									
Formaldehyde, 40% vol.....	ton	75	0	0	to	76	0	0	
Formosul (Rongalite).....	lb.	0	2	1	to	0	2	2	
Glauber salts, commercial.....	ton	4	0	0	to	4	10	0	
Glycerin crude.....	ton	65	0	0	to	67	10	0	
Hydrogen peroxide, 12 vols.....	gal	0	2	0	to	0	2	1	
Iron perchloride.....	ton	18	0	0	to	20	0	0	
Sulphate (Copperas).....	ton	3	10	0	to	4	0	0	
Lead acetate, white.....	ton	43	0	0	to	45	0	0	
Carbonate (White Lead).....	ton	43	0	0	to	45	0	0	
Nitrate.....	ton	44	10	0	to	45	0	0	
Litharge.....	ton	37	0	0	to	39	0	0	
Lithophone, 30%.....	ton	22	10	0	to	23	0	0	
Magnesium chloride.....	ton	3	10	0	to	3	15	0	
Carbonate, light.....	cwt.	2	10	0	to	2	15	0	
Sulphate (Epsom salts commercial).....	ton	5	15	0	to	6	0	0	
Sulphate (Druggists').....	ton	8	0	0	to	9	0	0	
Manganese Borate, commercial.....	ton	65	0	0	to	75	0	0	
Sulphate.....	ton	45	0	0	to	50	0	0	
Methyl acetone.....	ton	82	0	0	to	85	0	0	
Alcohol, 1% acetone.....	ton	105	0	0	to	110	0	0	
Nickel sulphate, single salt.....	ton	37	0	0	to	38	0	0	
Ammonium sulphate, double salt ton		37	0	0	to	38	0	0	

	Per	£	s.	d.	£	s.	d.	
Potash, Caustic.....	ton	30	0	0	to	32	0	0
Potassium bichromate.....	lb.	0	0	5½	to	0	0	6
Carbonate, 90%.....	ton	30	0	0	to	31	0	0
Chloride, 80%.....	ton	9	0	0	to	10	0	0
Chlorate.....	lb.	0	0	3½	to	—	—	—
Metabisulphite, 50-52%.....	ton	65	0	0	to	70	0	0
Nitrate, refined.....	ton	38	0	0	to	40	0	0
Permanganate.....	lb.	0	0	10	to	0	0	10½
Prussiate, red.....	lb.	0	3	0	to	0	3	2
Prussiate, yellow.....	lb.	0	1	0½	to	0	1	1½
Sulphate, 90%.....	ton	10	0	0	to	10	10	0
Salammoniac, firsts.....	cwt.	3	3	0	to	—	—	—
Seconds.....	cwt.	3	0	0	to	—	—	—
Sodium acetate.....	ton	25	0	0	to	25	10	0
Arsenate, 45%.....	ton	45	0	0	to	48	0	0
Bicarbonate.....	ton	10	10	0	to	11	0	0
Bichromate.....	lb.	0	0	4½	to	0	0	4½
Bisulphite, 60-62%.....	ton	21	0	0	to	23	0	0
Chlorate.....	lb.	0	0	3	to	0	0	3½
Caustic, 70%.....	ton	17	10	0	to	18	0	0
Caustic, 76%.....	ton	18	10	0	to	19	0	0
Hydrosulphite, powder.....	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial.....	ton	10	10	0	to	11	0	0
Nitrite, 96-98%.....	ton	27	10	0	to	28	0	0
Phosphate, crystal.....	ton	16	0	0	to	16	10	0
Perborate.....	lb.	0	1	0	to	0	1	1
Prussiate.....	lb.	0	0	6½	to	0	0	6½
Sulphide, crystals.....	ton	8	10	0	to	9	0	0
Sulphide, solid, 60-62 %.....	ton	14	10	0	to	15	10	0
Sulphite, cryst.....	ton	11	10	0	to	12	0	0
Strontium carbonate.....	ton	50	0	0	to	55	0	0
Nitrate.....	ton	50	0	0	to	55	0	0
Sulphate, white.....	ton	6	10	0	to	7	10	0
Sulphur chloride.....	ton	25	0	0	to	27	10	0
Flowers.....	ton	11	0	0	to	11	10	0
Roll.....	ton	9	15	0	to	10	10	0
Tartar emetic.....	lb.	0	1	2	to	0	1	3
Tin perchloride, 33%.....	lb.	0	1	1	to	0	1	2
Perchloride, solid.....	lb.	0	1	3	to	0	1	4
Protochloride (tin crystals).....	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.....	ton	20	0	0	to	21	0	0
Chloride, solid, 96-98%.....	ton	25	0	0	to	30	0	0
Oxide, 99%.....	ton	42	0	0	to	45	0	0
Dust, 90%.....	ton	50	0	0	to	55	0	0
Sulphate.....	ton	15	0	0	to	16	0	0

Pharmaceutical Chemicals

Acetyl salicylic acid.....	lb.	0	3	0	to	0	3	3
Acetanilid.....	lb.	0	1	6	to	0	1	9
Acid, Gallic, pure.....	lb.	0	3	0	to	0	3	3
Lactic, 1.21.....	lb.	0	2	4	to	0	2	8
Salicylic, B.P.....	lb.	0	2	1	to	0	2	3
Tannic, lewiss.....	lb.	0	3	2	to	0	3	4
Amidol.....	lb.	0	7	9	to	0	8	3
Amidopyrin.....	lb.	0	12	0	to	0	12	6
Ammon ichthosulphonate.....	lb.	0	1	10	to	0	2	0
Barbitone.....	lb.	0	17	6	to	0	18	6
Beta naphthol resublimed.....	lb.	0	1	9	to	0	2	0
Bromide of ammonia.....	lb.	0	0	7	to	0	0	6½
Potash.....	lb.	0	0	6	to	0	0	7½
Soda.....	lb.	0	0	7	to	0	0	7½
Caffeine, pure.....	lb.	0	10	9	to	0	11	0
Calcium glycerophosphate.....	lb.	0	5	9	to	0	6	0
Lactate.....	lb.	0	1	9	to	0	2	0
Calomel.....	lb.	0	3	9	to	0	4	0
Chloral hydrate.....	lb.	0	4	0	to	0	4	3
Cocaine alkaloid.....	oz.	0	19	6	to	1	0	0
Hydrochloride.....	oz.	0	16	9	to	0	17	3
Corrosive sublimate.....	lb.	0	3	3	to	0	3	6
Eucalyptus oil, B.P. (70-75% eucalyptol).....	lb.	0	2	4	to	0	2	6
B.P. (75-80% eucalyptol).....	lb.	0	2	5	to	0	2	8
Guaiacol carbonate.....	lb.	0	8	6	to	0	8	9
Liquid.....	lb.	0	8	9	to	0	9	3
Pure crystals.....	lb.	0	9	3	to	0	9	9
Hexamine.....	lb.	0	3	8	to	0	3	10
Hydroquinone.....	lb.	0	3	6	to	0	4	0
Lanoline anhydrous.....	lb.	0	0	7	to	0	0	7½
Lecithin ex ovo.....	lb.	0	17	6	to	0	19	0
Lithi carbonate.....	lb.	0	9	6	to	0	10	0
Methyl salicylate.....	lb.	0	2	4	to	0	2	10
Metol.....	lb.	0	9	0	to	0	10	0
Milk sugar.....	cwt.	4	2	6	to	4	5	0
Paraldehyde.....	lb.	0	1	5	to	0	1	6
Phenacetin.....	lb.	0	6	0	to	0	6	3
Phenazone.....	lb.	0	7	6	to	0	7	9
Phenolphthalein.....	lb.	0	6	9	to	0	7	0
Potassium sulpho guaiacolate.....	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.....	oz.	0	2	3	to	—	—	—

	Per	£	s.	d.	to	£	s.	d.
Resorcin, medicinal.....lb.	0	5	6	to	0	5	9	
Salicylate of soda powder.....lb.	0	2	6	to	0	2	9	
Crystals.....lb.	0	2	6	to	0	2	8	
Salol.....lb.	0	3	0	to	0	3	3	
Soda Benzoate.....lb.	0	2	4	to	0	2	6	
Sulphonal.....lb.	0	14	0	to	0	14	6	
Terpene hydrate.....lb.	0	1	9	to	0	2	0	
Theobromine, pure.....lb.	0	10	6	to	0	11	0	
Soda salicylate.....lb.	0	7	6	to	0	7	9	
Vanillin.....lb.	1	3	0	to	1	4	0	

Coal Tar Intermediates, &c.

Alphanaphthol, crude.....lb.	0	2	0	to	0	2	3	
Refined.....lb.	0	2	6	to	0	2	9	
Alphanaphthylamine.....lb.	0	1	6½	to	0	1	7	
Aniline oil, drums extra.....lb.	0	0	9	to	0	0	9½	
Salts.....lb.	0	0	9½	to	0	0	10	
Anthracene, 40-50%.....unit	0	0	8½	to	0	0	9	
Benzaldehyde (free of chlorine).....lb.	0	2	6	to	0	2	9	
Benzidine, base.....lb.	0	4	9	to	0	5	0	
Sulphate.....lb.	0	3	9	to	0	4	0	
Benzoic acid.....lb.	0	2	0	to	0	2	3	
Benzyl chloride, technical.....lb.	0	2	0	to	0	2	3	
Betanaphthol.....lb.	0	1	1	to	0	1	2	
Betanaphthylamine, technical.....lb.	0	4	0	to	0	4	3	
Croceine Acid, 100% basis.....lb.	0	3	3	to	0	3	6	
Dichlorobenzol.....lb.	0	0	9	to	0	0	10	
Diethylaniline.....lb.	0	4	6	to	0	4	9	
Dinitrobenzol.....lb.	0	1	1	to	0	1	2	
Dinitrochlorbenzol.....lb.	0	0	11	to	0	1	0	
Dinitronaphthalene.....lb.	0	1	4	to	0	1	5	
Dinitrotoluol.....lb.	0	1	4	to	0	1	5	
Dinitrophenol.....lb.	0	1	6	to	0	1	7	
Dimethylaniline.....lb.	0	2	9	to	0	3	0	
Diphenylamine.....lb.	0	3	6	to	0	3	9	
H-Acid.....lb.	0	4	9	to	0	5	0	
Metaphenylenediamine.....lb.	0	4	0	to	0	4	3	
Monochlorbenzol.....lb.	0	0	10	to	0	1	0	
Metanilic Acid.....lb.	0	5	9	to	0	6	0	
Metatoluylenediamine.....lb.	0	4	0	to	0	4	3	
Monosulphonic Acid (2.7).....lb.	0	8	6	to	0	9	6	
Naphthionic acid, crude.....lb.	0	2	6	to	0	2	8	
Naphthionate of Soda.....lb.	0	2	6	to	0	2	8	
Naphthylamin-di-sulphonic acid.....lb.	0	4	0	to	0	4	3	
Neville Winther Acid.....lb.	0	7	3	to	0	7	9	
Nitrobenzol.....lb.	0	0	7	to	0	0	8	
Nitronaphthalene.....lb.	0	0	11½	to	0	1	0	
Nitrotoluol.....lb.	0	0	8	to	0	0	9	
Orthoamidophenol base.....lb.	0	12	0	to	0	12	6	
Orthodichlorobenzol.....lb.	0	1	0	to	0	1	1	
Orthotoluidine.....lb.	0	0	10	to	0	0	11	
Orthonitrotoluol.....lb.	0	0	3	to	0	0	4	
Para-amidophenol, base.....lb.	0	8	6	to	0	9	0	
Hydrochlor.....lb.	0	7	6	to	0	8	0	
Paradichlorobenzol.....lb.	0	0	9	to	0	0	10	
Paranitraniline.....lb.	0	2	7	to	0	2	9	
Paranitrophenol.....lb.	0	2	3	to	0	2	6	
Paranitrotoluol.....lb.	0	2	9	to	0	3	0	
Paraphenylenediamine, distilled.....lb.	0	12	0	to	0	12	6	
Paratoluidine.....lb.	0	5	6	to	0	5	9	
Phthalic anhydride.....lb.	0	2	6	to	0	2	9	
Resorcin, technical.....lb.	0	4	0	to	0	4	3	
Sulphanilic acid, crude.....lb.	0	0	10	to	0	0	11	
Tolidine, base.....lb.	0	7	3	to	0	7	9	
Mixture.....lb.	0	2	6	to	0	2	9	

Essential Oils and Synthetics

	ESSENTIAL OILS.	£	s.	d.
Anise.....c.i.f. 1/9 spot	0	1	11	
Bay.....	0	12	0	
Bergamot.....firmer	0	12	6	
Cajaput.....	0	3	6	
Camphor, white.....per cwt.	4	0	0	
Brown.....	3	15	0	
Cassia.....easier, c.i.f. 10/6 spot	0	11	6	
Cedarwood.....	0	1	4½	
*Citronella (Ceylon), Sept.-Oct. 3/2, unobtainable on spot	0	3	11	
(Java).....Sept.-Oct. 3/11,	0	4	2	
Clove.....	0	7	6	
Eucalyptus.....dearer and firm	0	2	6	
Geranium Bourbon.....	1	10	0	
Lavender.....firmer and dearer	0	19	0	
Lavender spike.....	0	2	9	
Lemon.....	0	2	11	
Lemongrass.....per oz.	0	0	2½	
Lime (distilled).....	0	4	0	
Orange sweet (Sicilian).....easier	0	11	0	
(West Indian).....easier	0	9	0	

* Almost unobtainable.

	£	s.	d.
Palmarosa.....	1	3	0
Peppermint (American).....dearer	0	15	6
† Mint (dementolised Japanese).....easier	0	12	6
Patchouli.....	1	10	0
Otto of Rose.....per oz.	1	15	0
Rosemary.....	0	1	7
Sandalwood.....	1	6	0
Sassafras.....	0	6	0
Thyme.....2/6 to	0	8	0

† Dearer and market very nominal, but tending easier.

SYNTHETICS.

Benzyl acetate.....	0	3	0
Benzoate.....	0	3	0
Citral.....	0	10	0
Coumarine.....	0	18	6
Heliotropine.....	0	8	0
Ionone.....	1	5	0
Linalyl acetate.....	1	2	6
Methyl salicylate.....	0	2	6
Musk xylol.....	0	11	0
Terpenol.....firmer	0	3	0

Chile Nitrate Sales

THERE is a slight improvement to report in general business conditions in Chile, according to a cable message, dated September 12, from the Valparaiso branch of the Anglo-South American Bank. The exchange market is more active, and the 90 days' sight rate on London has shown a slight but steady tendency to improve, the quotation of 35.80 giving to the peso a sterling value of 6 23-32d., as against 6 9-16d. in the previous week. A decided recovery has occurred in nitrate sales, the amount disposed of during the past week for delivery in the nitrate year 1923-24 totalling 1,440,163 metric quintals, as compared with only 108,912 quintals in the preceding week. The total amount of the fertiliser sold for delivery during the period mentioned is now 10,822,379 quintals.

Although the official trade figures for the first half of 1923 have not yet been published, statistics of the principal items of import and export for that period show that there has been an increase in trade as compared with the first six months of 1922. The value of 35 principal articles of importation totalled \$41,403,648 gold of 18d. for the period January-June, 1923, whilst the value of the 28 principal items of export was \$194,317,213. The respective figures for the corresponding period of 1922 were \$30,338,242 and \$118,905,433.

Problems of Industry

THE seventeenth lecture conference, organised by Mr. B. Seebohm Rowntree, for works directors, managers, foremen, and forewomen, opened at Balliol College, Oxford, on Thursday. The special purpose of these gatherings is the better equipment of industrial leaders to deal with the problems in relation to labour which confront industry with seemingly greater urgency than ever. The opening lecture on "Business Outlook" was delivered by Professor J. H. Jones, head of the Department of Commerce at Leeds University. "Motive in Industry" will be discussed by Mr. W. Piercy; "Industrial Peace," by Mr. J. H. Thomas, M.P.; "Methods of Remuneration," by Mr. Clarence H. Northcott; "Trade Forecasts and Their Value," by Mr. H. D. Hendson; "The Old and the New in Business," by Mr. L. Urwick; "The Health of the Worker," by Dr. R. M. Wilson; and "The Ethics of Industry," by Mr. John Lee.

Advance in German Finishers' Charges

A COLOGNE report states that German merchants are complaining very much of the high charges which the finishing sections of the cotton trade will make this month. The Chemnitz and District Federation of Bleachers and Dyers have notified an immediate advance of 100 per cent. for bleaching cotton yarn, the amount now required for dealing with 100 kilograms being 50 gold marks, as against 16 marks before the war. The Federation of Finishers of Cotton Piece Goods, whose headquarters are at Leipzig, announces a similar increase. The new charge for bleaching and finishing a piece of cotton of light quality, which, before the war, was 10 marks, is 25 gold marks. It is stated that for some time the bulk of the trade in bleached cotton goods has been for export, but it is thought that with prices at the new levels it will be impossible to compete with foreign producers.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, September 20, 1923.

DURING the past week business has been, if anything, a little more satisfactory, but the number of orders booked still leaves much to be desired.

Prices, on the whole, are steady, and there is no change of importance to record.

Industrial Chemicals

ACID ACETIC, Glacial 98/100%, £60 to £65 per ton in casks; 80% pure, £51 to £52 per ton; 80% technical, £47 to £48 per ton, c.i.f. U.K. ports, duty free.

ACID BORACIC.—Crystals or granulated, £48 per ton; powdered, £50 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC (Ice Crystals).—Unchanged at 1s. 2d. per lb.

ACID CITRIC.—Moderate inquiry and price unchanged at 1s. 5½d. per lb., less 5%.

ACID FORMIC, 80%.—Quoted £51 to £52 per ton, ex store, spot delivery.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC 80%.—About £23 10s. per ton, ex station, full truck loads.

ACID ONALIC.—Quoted 6d. per lb., but could probably be obtained at slightly less.

ACID SULPHURIC.—144°, £3 15s. per ton; 168°, £7 per ton, ex works, full truck loads. De-arsenicated quality, 20s. per ton more.

ACID TARTARIC.—B.P. crystals now offered at 1s. 1¾d. per lb., less 5 per cent.

ALUM, POTASH (Lump).—Spot material on offer at £11 per ton, ex store.

AMMONIA, ANHYDROUS.—Moderate export inquiry. Offered at 1s. 4½d. per lb., f.o.b. U.K. port.

AMMONIA, CARBONATE.—Lump, 4d. per lb.; ground, 4½d. per lb., delivered.

AMMONIA, LIQUID 88°.—Quoted 3½d. per lb., ex station.

AMMONIA, MURIATE.—Grey galvanisers quality, unchanged at £31 to £32 per ton; fine white crystals offered at £24 per ton, ex wharf, spot delivery.

AMMONIA, SULPHATE.—25¼%, £12 17s. per ton; 25¾%, neutral quality, £14 per ton, ex works, September.

ARSENIC, WHITE POWDERED.—Spot lots now offered at about £70 per ton, ex quay.

BARIUM CHLORIDE 98/100%.—Unchanged at about £15 per ton, ex store, spot delivery.

BARYTES.—Finest white English, £5 5s. per ton, ex works.

BLEACHING POWDER.—Spot lots, £11 5s. per ton, ex station. Contracts, 20s. per ton less.

BORAX.—Granulated, £24 10s. per ton; crystal, £25 per ton; powdered, £26 per ton, carriage paid U.K. stations. Minimum ton lots.

CALCIUM CHLORIDE.—English make unchanged, £5 12s. 6d. per ton, ex station. Continental material about 15s. per ton cheaper.

COPPERAS, GREEN.—About £2 2s. 6d. per ton, f.o.b. U.K. port.

FORMALDEHYDE 40%.—Quoted £94 to £95 per ton, ex store, spot delivery. Much cheaper offers for forward delivery.

GLAUBER SALTS.—Fine white crystals, £3 10s. to £3 15s. per ton, ex store.

LEAD, RED.—English material, £40 per ton, carriage paid U.K. stations. Continental about £36 per ton, ex store, spot delivery.

LEAD, WHITE.—Continental material on offer at about £37 per ton, c.i.f. U.K. ports.

LEAD ACETATE.—White crystals quoted £41 to £42 per ton, ex wharf, spot delivery. Offered from Continent at about £38 per ton, c.i.f. U.K. ports.

MAGNESITE, GROUND CALCINED.—English material unchanged at about £8 to £8 5s. per ton, ex station. Finest continental about £7 10s. per ton, c.i.f. U.K. ports.

MAGNESIUM CHLORIDE.—Rather cheaper offers from the continent at about £2 12s. 6d. per ton, c.i.f. U.K. ports. Spot material about £3 2s. 6d. per ton, ex store.

MAGNESIUM SULPHATE (Epsom Salts).—Commercial quality, £7 per ton, B.P. quality, £8 5s. per ton, ex station.

POTASH, CAUSTIC 88/92%.—Quoted £31 to £32 per ton, ex store, spot delivery. Continental quotations about £29 per ton, c.i.f. U.K. port.

POTASSIUM BICHROMATE.—Unchanged at 5½d. per lb. delivered.

POTASSIUM CARBONATE 96/98%.—Quoted £29 15s. per ton, ex store, spot delivery. Offered from continent at about £26 15s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE.—Unchanged at about 3d. per lb.

POTASSIUM PERMANGANATE.—B.P. crystals, price now 10½d. per lb., ex store.

POTASSIUM PRUSSATE (Yellow).—Now quoted about 1s. per lb., ex store. In little demand.

SODA CAUSTIC.—76/77%, £19 7s. 6d. per ton; 70/72%, £17 17s. 6d. per ton; 60/62% broken, £19 2s. 6d. per ton; 98/99% powdered, £22 15s. per ton. All ex station, spot delivery. Contracts, 20s. per ton less.

SODIUM ACETATE.—Spot lots about £25 10s. per ton, ex store. Offered from continent at £24 per ton, c.i.f. U.K. ports.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station; M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb., delivered.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station. Alkali 58%, reduction of 1s. 3d. per ton. Now £8 14s. 9d. per ton, ex quay.

SODIUM HYPOSULPHITE.—Continental quotations of about £8 2s. 6d. per ton, c.i.f. U.K. ports. Spot lots £10 per ton, ex store. Pea crystals unchanged at about £14 10s. per ton, ex store.

SODIUM NITRATE.—Refined 96/98% unchanged at about £13 7s. 6d. per ton, f.o.r. or f.o.b. U.K. port.

SODIUM NITRITE, 100%.—About £26 to £28 10s. per ton, according to quantity. Moderate export inquiry.

SODIUM PRUSSATE (Yellow).—Now quoted at 6d. per lb., ex store.

SODIUM SULPHATE (Saltcake).—Price £4 per ton, ex station, for home consumption.

SODIUM SULPHIDE.—Continental quotations of about £13 10s. per ton, c.i.f. U.K. ports. Spot lots about £14 15s. per ton, ex store.

SULPHUR, Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN, CRYSTALS.—Unchanged at 1s. 4d. per lb.

ZINC, SULPHATE.—Continental material now quoted about £13 10s. per ton, c.i.f. U.K. ports. Spot lots about £14 5s. per ton, ex store.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ANILINE OIL.—Good export demand. Price quoted, 10½d. to 11d. per lb., f.o.b., drums included.

BENZIDINE BASE.—Large export inquiries. Price 4s. 9d. per lb., 100% basis.

BENZIDINE SULPHATE is in moderate demand. Price 6s. per lb., 100% basis, carriage paid.

BENZOIC ACID.—Export inquiry. Price quoted, 1s. 10d. per lb., f.o.b.

BENZYL CHLORIDE.—Export inquiry. Price quoted, 1s. 11d. per lb., f.o.b., drums included.

DICHLOROBENZIDINE.—Export inquiry. Price quoted, 9s. per lb., f.o.b.

DINITROBENZOL.—Export inquiry. Price quoted, 1s. 3d. per lb., delivered.

META-NITRANILINE.—Price lower, at 5s. 3d. per lb.

META-NITRO-PARA-TOLUIDINE.—Occasional export inquiry. Price 8s. 2d. per lb., 100% basis.

ORTHO-NITRO-TOLUOL.—Small export inquiry. Price 5d. per lb., f.o.b., drums included.

ORTHO TOLUIDINE.—Small export inquiry. Price quoted, 11d. per lb., f.o.b., drums included.

PARA-AMIDO-DIPHENYLAMINE.—Small demand. Price 7s. 6d. per lb.

PARA-AMIDO-PHENOL.—Small export inquiry. Price quoted, 9s. 9d. per lb., 100% basis, f.o.b.
 PARA-AMIDO-SALYCILIC ACID.—Export inquiry. Price quoted, 8s. 6d. per lb., 100% basis, f.o.b.
 PARAPHENYLENEDIAMINE.—Small home inquiries. Price quoted, 12s 6d. per lb., delivered.
 PHTHALIC ANHYDRIDE.—Good home inquiry. Price 2s. per lb., delivered.

German Potash Industry

A Record Year

THE Commercial Secretary at Berlin (Mr. H. N. Sturrock) has forwarded to the Department of Overseas Trade a report from the *Industrie und Handels Zeitung* of September 5, which states that the year 1922 was a record one for the potash industry, the sales of pure potash increasing from 460,591 tons in 1921 to 647,722 tons in 1922, or 40 per cent. In a report on industry by the Commerz- und Privatbank it is stated, *inter alia*, as following with regard to the further development of the potash industry:—

It is clear to the potash industry that the enormous increase of sales in 1922 was not due solely to a growth of demand, but also in part to a covering in advance, having regard to the currency depreciation and to anticipation by customers of a further nominal increase of potash prices. During the first months of 1923 customers showed a certain reserve, which was, on the one hand, a natural reaction after large covering purchases, and on the other hand, was due to the anticipated effect of the action taken by the Reichsbank to stabilise the mark. When it became clear at the beginning of May that stabilisation could not be maintained, the demand of German agriculture set in on such a scale that, e.g. in June, the highest monthly sales so far recorded by the potash industry were effected, viz., 90,000 tons K_2O (as compared with average monthly sales of 50,000 tons). In spite of these large sales, the level of the previous year has not yet been reached, but it is assumed that the difference will be made good during the following months, provided no unforeseen circumstances arise. Foreign countries, in particular, should contribute thereto, as foreign sales in 1923 have so far been generally satisfactory. The fact must not, however, be lost sight of that difficulties of sale in the potash industry would arise immediately if the costs of production were rapidly adjusted to the gold parity but foreign exchanges were to show a sinking tendency. In such case, the potash industry would doubtless feel the competition of the Alsatian works on the world's market seriously. As before, the American and Dutch markets are the most important customers for German potash.

The income of the industry, measured by distributed profits, is, of course, as in the case of the whole of German industry, extremely meagre, particularly in proportion to the gold capital invested in it. In this connection it must be pointed out that the capital of the principal German potash undertakings, in spite of nominal increases, can scarcely, in the large majority of cases, be regarded as watered to any extent worth mentioning. The increases of capital almost everywhere served the purpose of affiliation with other works and of internal reforms. There was thus, in general, a corresponding increase of real values.

The internal consolidation of the industry by the closing down of unsatisfactory shafts and the amalgamation of individual works in concerns has made further progress since the last report. The present policy of concentration has proved exceedingly successful, and has resulted in a considerable reduction of the costs of production. Only thus has it been possible to keep the inland prices of potash comparatively low, so that the increase as compared with pre-war times is considerably less than in the case of other comparable products of German industry.

A New Floating Oil Separator

THE Clyde Navigation Trust have decided to instal a floating oil separator, and the contract, which has been secured by Smith's Dock Co., of the Tyne and the Tees, will be put in hand immediately. Owing to the provision for oil separating made by the Clyde Trust, vessels trading to the Clyde will no longer have to go out beyond the three-mile limit to clean out their oil tanks.

The Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, September 20, 1923.

MARKET conditions here during the past week have been much the same as during the whole of this month. Generally speaking, buyers are doing little more than nibbling, but they are nibbling more frequently than for some time past and there is a bigger volume of business being done, although, of course, still considerably less than chemical traders in this centre are normally used to. Prices on the whole keep steady, with here and there slightly added firmness where stocks in sellers' hands are light.

Heavy Chemicals

There is still a fairly good volume of business being done in saltcake for shipment; home demand is quiet, however, with prices steady at £4 5s. to £4 10s. per ton. Glauber salts meet with only a limited amount of inquiry at about £4 per ton. Bleaching powder is moderately active both for home and export, home trade prices being steady at £11 5s. per ton. Caustic soda continues in good demand for both branches of trade, with quotations firm at from £16 17s. 6d. per ton for 60 per cent. to £19 7s. 6d. per ton for 76-77 per cent. material, for home consumption. Soda crystals are rather quiet at £5 5s. per ton delivered. Alkali is in steady request both for home and export, price for the former being unchanged at £7 12s. 6d. per ton for 58 per cent. material. Prussiate of soda continues to be very inactive, though prices have been maintained at 5½d. to 6d. per lb. Bicarbonate of soda is firm and in steady demand at £10 10s. per ton delivered. Hyposulphite of soda keeps quiet with photographic crystals on offer at £14 to £14 10s., and commercial at £9 10s. per ton. Sulphide of soda is also inactive; current quotations are round £14 10s. per ton for 60-65 per cent. concentrated solid and £8 10s. per ton for crystals. Nitrite of soda is well maintained at £26 10s. per ton, demand being fairly active and available supplies short. Chlorate of soda meets with a fair inquiry at 2½d. per lb. Phosphate of soda is quiet, but steady at about £15 per ton. Bichromate of soda is firm and in steady demand at 4½d. per lb. Acetate of soda is still in rather short supply and prices are maintained at about £24 per ton.

Caustic potash is in good demand and prices are very firm at £29 to £30 per ton for 88-90 per cent. material. Carbonate of potash is in much the same position; 90-92 per cent. quality is quoted at £28 and 96-98 per cent. at £29 10s. per ton. Yellow prussiate of potash is quiet at about 1s. 1d. per lb. Bichromate of potash is steady and in moderate demand at 5½d. per lb. Permanganate of potash is still inactive at 9d. to 9½d. per lb. Chlorate of potash is selling fairly freely with prices firm at round 3d. per lb.

Sulphate of copper shows little or no improvement and prices are barely steady at £25 10s. to £26 per ton, f.o.b. Arsenic is easier on a less pressing demand; white powdered, Cornish makes, is now offered at slightly under £70 per ton, Manchester. Nitrate of lead is quiet, but steady at £42 per ton. White sugar of lead is very firm at £41 per ton, and brown at £42 to £43; supplies are still scarce for early delivery. Acetate of lime is well maintained at £21 for grey and £12 per ton for brown. Commercial Epsom salts are steady and in fair demand at £4 per ton; magnesium sulphate, B.P., is unchanged at £6.

Acids and Tar Products

Little business is being done in tartaric acid, though prices are steady at 1s. 1½d. to 1s. 2d. per lb. Citric acid is also featureless at 1s. 8d. per lb. Oxalic acid is dull, but fairly steady at 5½d. per lb. Acetic acid is firm and in good demand at £47 to £48 per ton for 80 per cent. technical and £65 per ton for glacial.

Pitch is nominally easier in the absence of buying of any importance and quotations now range between £6 and £7 per ton, Manchester. Creosote oil is steady at 8½d. per gallon, but buyers are scarce. Solvent naphtha is quiet and easier at 1s. 3d. to 1s. 4d. per gallon. Carboic acid keeps firm at 3s. 4d. to 3s. 6d. per gallon for crude, and 1s. 2½d. per lb. for crystals. Naphthalenes are steady and in moderate inquiry at £20 for refined, and £7 to £13 per ton for crude, according to grade.

Company News

DOMINION GLASS CO.—A quarterly dividend of 1½ per cent. on common stock has been declared.

RAY CONSOLIDATED COPPER CO.—The report for the quarter ended June 30 last, shows an operating profit of \$496,509.

CRAIG AND ROSE, LTD.—The directors announce payment of the usual dividend on the preference shares of 5s. per share.

SHAWINIGAN WATER AND POWER.—A dividend of 1½ per cent. for the quarter ending September 30 will be paid on October 10.

ASBESTOS CORPORATION OF CANADA.—Dividends are announced at the rate of 1½ per cent. on the preferred stock, and 1 per cent. on the common stock, for the quarter to September 30.

VAN DEN BERGHS, LTD.—The directors announce an interim dividend of 1s. per share on the ordinary shares in respect of the year 1923. A similar dividend was declared for 1922.

BROKEN HILL SOUTH.—A final dividend for the year ended June 30 last at the rate of 1s. 6d. per share is payable on November 2. A year ago the dividend was at the rate of 2s. per share.

BENZOL AND BY-PRODUCTS, LTD.—An interim dividend of 3 per cent. on the preference shares is payable on October 1. The transfer books will be closed from September 24 to October 1 inclusive.

BRITISH ALUMINIUM CO.—A dividend is announced at the rate of 5 per cent. per annum, less tax, on the ordinary shares for six months to June 30 last, payable on October 1. This is the same as a year ago.

THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD.—The transfer books and register of members of the company's 5½ per cent. cumulative preference shares are closed until September 30, for the preparation of the half-yearly dividend warrants.

SHAMVA MINES.—An interim dividend of 5 per cent., less tax, for the current quarter is announced (being the third interim dividend for the year ending December 31), payable on October 18. A year ago the dividend was 6½ per cent. The transfer books will be closed from September 24 to 27 inclusive.

BURT, BOULTON AND HAYWOOD, LTD.—It is announced that this company are offering to shareholders registered on September 8 88,000 ordinary shares of £1 each at par, payable 5s. per share on application, on December 12, 1923, and on January 16 and March 26, 1924, respectively. The right of renunciation is given, and the allotment letter will be split once. The new shares will rank for dividend from January 1, 1924. Application forms must be returned to the National Provincial and Union Bank of England, Princes Street, London, E.C.2, on or before October 3.

THE CALICO PRINTERS' ASSOCIATION.—At the twenty-fourth ordinary general meeting, held in Manchester on Wednesday, the chairman, Mr. Lennox Lee, in moving the adoption of the directors' statement of profit and loss and the balance-sheet, said that the balance available for distribution was £1,037,579, which the directors recommended should be applied in the following manner: A dividend at the rate of five per cent. per annum on the preference shares; a dividend of ten per cent. and a bonus of two and a half per cent. on the ordinary shares; a grant of £100,000 to the Employees' Benefit Fund; £150,000 to the Reserve for Equalisation of Dividends; and £150,000 to the Reserve Account, leaving a sum of £235,000 to be carried forward.

BRITISH CELLULOSE AND CHEMICAL MANUFACTURING CO., LTD.—The accounts for the twenty months ended February 28 last show a net loss of £491,781, as follows:—Loss from manufacturing accounts, £210,538; amount written off on revaluation of stocks, £57,463; depreciation of surplus unerected plant and losses on plant sold or wholly written off, £229,270; losses on cancellation of erection contracts, £11,216; debenture and other interest received, £35,250. After deducting transfer fees there remains a total of £542,476. From this is deducted £50,695, balance of reduction of capital account unappropriated, leaving the loss mentioned of £491,781. It is pointed out that

of this total only £210,537 is due to trading over the twenty months under review. The balance consists of non-trading losses, and also the sum lost on the sale of Spondon Power House, amounting in itself to over £114,000. The board recommend that the name of the company be changed to British Celanese, Limited, so as to abbreviate and identify it more closely with the company's principal product, "celanese." The ordinary general meeting will be held at the Great Hall, Cannon Street Hotel, London, on September 27, at 12 o'clock noon.

"Chemical Age" Inquiry List

The following inquiry has been received from a reader of "The Chemical Age." Replies addressed to the box number given below, c/o "The Chemical Age," 8, Boulevard Street, London, E.C.4, will be forwarded to the inquirer.

A large Danish agency firm seeks representation in chemicals, oils, metals, and tar products. No. H.30.

Demand for Pitch in Italy

H.M. CONSUL at Turin (Mr. R. L. Nosworthy) reports that a local railway company is in the market for a considerable amount of pitch for use in the manufacture of briquettes (*mattonelle carbone*). United Kingdom firms desirous of receiving further particulars regarding this matter should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 20579/F.W./M.C.2.

Tariff Changes

UNION OF SOUTH AFRICA.—A recent proclamation fixes, for the purpose of levying Customs duties, the following minimum rates of freight at which cement and superphosphates shall be carried to the Union:—In the case of cement imported from Great Britain, 17s. 6d. per ton of 2,000 lb. gross weight, or per ton of 2,240 lb. gross weight. The proclamation states that if such goods are carried into the Union at lower rates of freight than those specified above, there shall be levied thereon a dumping freight duty equal to the difference between the net rates paid or to be paid and the rates above specified.

Catalogues Received

A. GALLINKAMP AND CO., LTD.—We have received from the above-mentioned firm of 19 and 21, Sun Street, Finsbury Square, London, E.C.2, a price list of surplus graduated glassware, and a leaflet describing a special offer of acid-proof laboratory coats at 30s. each, and laboratory water-baths. We have also received from the same firm a price list of Kavalier's Bohemian glassware.

A. R. TATTERSALL AND CO.—A leaflet describing the "Geyser" mixer has been received from this firm of 75, Mark Lane, London, E.C.3. This machine, which is suitable for mixing any kinds of powders, works by means of a vertical conical worm, which is claimed to absorb much less power than the more usual parallel worm. The machine also has other interesting features of practical value.

TOWNSON AND MERCER, LTD.—This firm have recently placed on the market Stainer's Absorption Pipette, which is a device for the more rapid absorption of carbon monoxide in connection with the Orstat type of gas analysis apparatus. The construction is so devised that the gas passes through the cuprous chloride absorbing solution on leaving as well as entering the bulb. The apparatus, which is priced at 10s. 6d. net, is described and illustrated in a leaflet issued by the above firm from 34, Camomile Street, London, E.C.3.

PATERSON HUGHES ENGINEERING CO., LTD.—The importance of mechanical handling of materials in works of all kinds is now generally recognised. In the catalogue recently issued by the above firm from 36, Charlotte Lane, Glasgow, will be found descriptions and illustrations of various types of mechanical conveyors. These include band conveyors of hollow section for coal, solid chemical products, etc., slat conveyors and flat band conveyors for boxes, cases, etc., and gravity roller conveyors, which carry cases, etc., without the use of power. In addition there will be found particulars of bucket elevators for vertical work, lifts, portable loaders and stackers. Altogether the various requirements in modern works equipment in this direction seem to be well covered.

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All communications should be
addressed to

The British Alizarine Co., Ltd.
Trafford Park, Manchester

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

IDEAL CLEANERS AND DYERS, LTD., London, W. (M., 22/9/23.) Registered September 5th, £1,000 and £1,000 debentures, part of £5,000; general charge. *£6,000. June 21, 1923.

Receivership

LOCKWOOD (DONALD) AND CO., LTD. B. Hennell, of 165-7, Moorgate Street, E.C., ceased to act as receiver or manager on August 31, 1923.

Bill of Sale

MOTTERSHEAD, Thomas Henry, 82, Tootal Drive, Weaste, chemical merchant. (B.S., 22/9/23.) September 15. £50.

London Gazette

Notices of Intended Dividends

CALVERT, Jackson, "Wagaraw," Greenhead Road, Huddersfield, manufacturing chemist. Last day for receiving proofs, October 3, 1923. Trustee, W. Durrance, Official Receiver, 12, Duke Street, Bradford.

RICHARDSON, Thomas, 95, Bank Road, Bootle, lately trading as the Evergloss Company, at Shorey Bank, Darwen, polish manufacturer. First meeting, September 27, 11 a.m., Offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination, October 23, 10.30 a.m., Court House, Government Buildings, Victoria Street, Liverpool.

Companies Winding Up Voluntarily

"E.C." POWDER CO. (THE), LTD. (C.W.U.V., 22/9/23.) R. W. Liddell appointed liquidator.

SIGNET SALT CO., LTD. (C.W.U.V., 22/9/23.) J. Lonie, 32, Ilfracombe Gardens, Monkseaton, appointed liquidator.

VEGLENE OIL REFINERY AND CHEMICAL WORKS (THE), LTD. (C.W.U.V., 22/9/23.) Meeting of creditors at the liquidator's office, 31, Queen Street, Cardiff, on September 21, at 3 p.m. Particulars of claims by October 21.

Bankruptcy Information

SHILVOCK, Thomas James, trading as SHILVOCK, SON AND CO., Globe Chambers, 493, New Cross Road, London, dealer in chemicals. (R.O., 22/9/23.) Receiving order, September 11. Creditor's petition. First meeting, September 21, 11.30 a.m., 29, Russell Square, W.C.1. Public examination, October 16, 11 a.m., The Court House, Greenwich.

New Companies Registered

ASHBY SOAPS, LTD., 51, Wardwick, Derby. Soap and candle makers, manufacturers of and dealers in tallow, oil, glycerine, chemicals, paints, dyes, colours, etc. Nominal capital, £30,000 in £1 shares (15,000 7 per cent. "A" cumulative preference, 9,000 7 per cent. preferred and 6,000 ordinary).

BRIQUETTE BINDERS, LTD., Letricheux Buildings, Swansea. Dealers in pitch, and reconditioners thereof, for the purpose of its being used for the manufacture of patent fuel; manufacturers of and dealers in coke, coal, tar, pitch, ammoniacal liquor; naphtha distillers; manufacturers of alizarine, coal tar colours, etc. Nominal capital, £30,000 in £1 shares.

ROBERT INGHAM CLARK AND CO. (SCOTLAND), LTD. Manufacturers of paint, enamel and varnish; manufacturers of and dealers in chemical, industrial and other preparations. Nominal capital, £20,500 in 20,000 7 per cent. participating preference shares of £1 and 10,000 ordinary shares of 1s. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, W.1.

WILLIAM GREEN (STOURPORT), LTD., 1, York Street, Stourport, Worcs. Chemists, druggists, drysalts, oil and colourmen, etc. Nominal capital, £500 in £1 shares.

JOHN GREENHALGH (VIGO PRODUCTS), LTD., 61, Old Broad Street, London, E.C.2. Tallow melters and refiners; soap boilers; fat, tallow, lard-compound, oil, glycerine, wax and general grease manufacturers, etc. Nominal capital, £3,000 in £1 shares.

H. P. REES, LTD., 26, Larkhill Place, Clubmoor, Liverpool. Chemists, druggists, drysalts, oil and colourmen. Nominal capital, £2,000 in £1 shares.

Voluntary Liquidation of W. N. Monks and Co.

A MEETING of the creditors of W. N. Monks & Co., Ltd., of 38, Silverwell Lane, Bolton, wholesale druggists and drysalts (in voluntary liquidation), was held on September 17 at the offices of the Master Cotton Spinners, Bolton, when the largest creditor, Mr. Hudson, was elected to the chair. A statement of affairs presented disclosed liabilities £3,334 1s. 8d., of which £2,730 12s. 1d. was due to unsecured creditors, while the bank were creditors for £603 9s. 7d. The total assets were £1,919 1s. 8d., from which had to be deducted £41 11s. 1d. for preferential claims, leaving net assets £1,877 10s. 7d., or a deficiency of £1,456 11s. 1d. The liquidator of the company, Mr. H. Whittaker, stated that the company was formed on July 1, 1919, with a nominal capital of £5,000, of which £2,500 had been issued for cash. Accounts showed that from the inception of the company down to June last there had been a net loss made of £1,342. The present position was attributed to mismanagement and incompetency in buying, and also to cutting prices with a view to obtaining more business.

It was decided to confirm the appointment of Mr. Whittaker as liquidator of the company, with an advisory committee of five of the principal creditors, consisting of Mr. Hudson, Mr. Roscoe, Mr. Bailey, Mr. York and Mr. Parkin S. Booth, of Liverpool.

The Resin of Hevea Rubber

PROFESSOR G. S. WHITBY read a paper entitled "The Nature and Significance of the Resin of Hevea Rubber," before the Chemistry Section at the British Association on Friday, September 14. He said that the resin of raw rubber, which constitutes about 3 per cent. of the material, has been found to contain liquid unsaturated acids, a new solid fatty acid (Heveic acid), a phytosterol glucoside, a phytosterol ester, a free phytosterol, quebrachitol, and *d*-valine. The acids have a marked influence on the vulcanisation of rubber in the presence of catalysts. The introduction into the rubber of stong bases has a striking effect in increasing the rate of vulcanisation with catalysts and in enhancing the tensile strength of the product. This effect is not due merely or mostly to the elimination, by neutralisation, of the retarding influence of acids, but is due largely to the dispersing action on the caoutchouc of the soaps produced. The total resin-acid-content of different samples of raw rubber varies greatly. Such variation is probably an important factor in vulcanisation by rubber samples. The ability of the resin constituents and of certain related substances to act as emulsifying agents has been studied. The ability of a wide range of organic substances to swell rubber has been studied in relation to the question of the mode of occurrence of the resin constituents in latex and in rubber.

Discovery of Potash in Czechoslovakia

THE *Gazette de Prague* reports that M. Jahn, professor of geology at the Brno Polytechnic School, and the chemist M. Prokes have discovered large deposits of potash in Czechoslovakia, estimated to contain several million tons, which will assure the country for a long time to come of an adequate supply of potash fertilisers.

